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RESEARCH ARTICLE

Evaluation of Grout Curtain Performance and Seepage Behavior in Doosti Dam, Iran

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ABSTRACT

Design and construction of civil structures such as dams require deep understanding of geological and geotechnical engineering conditions of rock masses in their site. Doosti Dam site consists of sedimentary rocks such as calcareous marl, siltstone, sandstone and sandy limestone of Mesozoic (Cretaceous) and early Tertiary of the Kopet-Dagh basin. In this study, permeability and hydraulic conductivity conditions of dam site were evaluated based on Lugeon tests and were presented as maps. Additionally, rock mass discontinuities in dam site and their properties were determined. The effects of geological engineering properties of discontinuities and permeability of different rock units on grout takes in the grout curtain were assessed. To compare the results, grouting performance was presented in the form of iso-cement take curves in the curtain rows. Finally, areas with poor performance were determined based on the obtained information. These points are pathways for water escape and pose risk on dam's stability during operation, which mandates a re-grouting program.

Key words: Engineering Geology, Seepage, Grout Curtain, Lugeon, Cement Takes.

INTRODUCTION

The greatest causes of failure in earth and rock-fill dams are dam overtopping, erosion due to seepage through dam body and foundation(piping) and the weakness in foundation (ICOLD ,1995). Due to the presence of discontinuities with unknown properties, there is a need to reinforce and improve the engineering properties and water tightness of rock mass. Grouting is a method often applied as a soil and ground improvement method. Grouting can be defined as the injection of flowable materials into the ground (usually) under pressure to alter and/or improve the engineering characteristics and/or behavior of the ground. Modification of the ground by filling voids and cracks dates back more than two centuries (ASCE 2010, Weaver and Bruce 2007).Construction of grout curtain by cement injection is the most common method of bedrock improvement (Houlsby 1992, Verfel 1989, Deer 1982). There are several examples of application of grout injection to rehabilitate the dam site. (Ewert 1985, Waver1991, Lombardi 2003,Warner 2004). The effectiveness and quality of grouting is controlled by numerous factors(Bruce&Dreese, 2010).Geological factors including geological formations in the region, the bed rock location, engineering properties of soil and rock, discontinuities, permeability, etc. have significant role in the successful construction of grout curtain. Among these, the number and the arrangement of discontinuities as water transfer and flow pathways are of special importance (Ewert, 2005).

Doosti Dam is constructed on Hariroud River in northeastern Iran on the border of Iran and Turkmenistan As shown in Figure 1. The dam is located about 180 km east of Mashhad, 75 km south of Sarakhs and 4 km upstream of the old bridge (Khatun bridge) in 61° 09.50' east and 35° 56.30'north. It is a rock-fill dam with silty core. Its height is 78 m above foundation, the crest is 670 meters long and 15 meters wide. The heel is 416 meters wide and its capacity in the normal level is 1250 million cubic meters.

Geology of the dam site

The project is extended through the easternmost parts of Hezarmasjed-KopetDagh tectonic zone. The Kopeh Dagh is a linear mountain range separating the shortening in Iran from the stable,flat Turkmenistan platform (Berberian&Yeats 1999,Walker&Jackson 2004). The Dam site is located in the northern ridge of an anticline with a general trend of NW-SE. In this area Hariroud is flowing through the rock strata from east to west. In the dam location, the overall slope of the valley walls is 30-35 degrees and the valley is U-shaped and symmetrical. Doosti Dam is constructed on hard calcareous and sandstone rocks on the right side and loose rocks including calcareous, marly and argillitic shale on the left side. Geological longitudinal profiles along the dam axis is presented in figure 2 .The oldest rock unit, which is in Abtalkh formation, is in the southernmost part of the dam axis where the spillway is located. It consists of blue to gray marls with interlayers of gray siltstone and thin argillite layers in the lower parts, fine grained calcareous siltstones and sandstones with fossiliferous blue to gray marl cement in the upper parts, and the total thickness of approximately 650 m. This is continued by Naeyzar formation consisting of fine to medium grained green glauconitic sandstones with interlayers of intensely eroded siltstones having numerous joints and fractures with 135 meters of thickness. The right abutment consists of rocky Kalat formation including alternations of sandy limestone, brown sandstone and siltstone and gray calcareous shale 220 m thick with abundant joints and fractures and minor faults. Continental red sediments of Pesteligh formation with high thickness are located on the Kalat formation and in contact with the dam lake on the right side. This formation consists of alternations of red sandstone, shale and siltstones with marl or argillite thin layers and a thick red conglomerate layer in the upper part. All rock layers of these formations have average strike of N85W and slope of 60-65 degrees towards the northeast.

Discontinuities system assessment

According to Palmström & Stille (2010) engineering properties of rock mass depend far more on the system of geological discontinuities within the rock mass than on the strength of intact rock.Acquiring reliable data on rock

discontinuities is necessary in almost every engineering project. In a dam site, discontinuities highly affect the foundation's strength and deformability, groundwater flow, water escape from the reservoir, slopes and tunnels stability, ease of blasting and the resulting blocks, and groutability of the foundation rock.

Various research to assess the general trend of geological structures in eastern Kopet-Dagh show that the overall resultant compressional forces in this region is in the northeast direction(Zamani,B., Angelier , Zamani,A., 2008). The forces on the dam site have formed geological structures, faults, and joints and fractures systems.

Existing faults in the area with overall trend of NE-SW and NW-SE have affected the rock mass in the dam site and sometimes resulted in displacement. Since the existing faults are small and have no significant effect on the overall structure of the dam site, their behaviors are not assessed here.

Joints, fractures and beddings

Doosti Dam discontinuities were studied in a thorough joint study campaign on the rock foundation in left abutment, bedrock and right abutment in the process of grout gallery construction. The gathered data were statistically analyzed using DIPS software. The results indicate that there are three main joint sets in addition to the bedding(Table 1).

The assessment of geometrical properties of discontinuities indicate that the bedding strike (E-W) is approximately perpendicular to the dam axis (N-S) and the bedding dip is directed toward the right side (NE). Bedding has the highest potential in water transmission from the dam lake to the downstream. Joint sets J1 and J2 have seepage potential as well. A comparison among the properties of discontinuities surfaces shows that these properties are similar to each other. Most of joints surfaces are smooth, mostly without filling and oxidized. Silt and clay are the major filling materials followed by calcite and gypsum. Their continuity is medium to high (3-10m) and their openness is less than 2.5 mm. Structural condition of joints and bedding surfaces in the dam site is presented in figure.3.

Evaluation of dam site seepage

Study of water movements and transmission in the site's rocks is essential in hydraulic structures. Safe and economic design of such structures requires sufficient information about the permeability of the foundation rock mass. Lugeon test is the most common test to determine the permeability of the rock strata. The test results are strongly related to the geometrical properties and weathering degree of water pathways (discontinuities) (Ewert 1997, Wei Jiang X. et al. 2009).

The rock permeability in abutments, foundation and dam structure in the depths were assessed using Lugeon test results in boreholes excavated for the phase I and II of study and A series boreholes during the implementation of grout curtain along the dam axis. The results are presented as Lugeon value iso-lines in figure 4.

As depicted in figure 4, the left abutment is impermeable and in maximum have very low permeability from near surface to the depth of 5 meters (LU<3). The rock foundation from the spillway area to the depth of 10 meters have low permeability (LU=3 to 10) and is impermeable in higher depths.

The foundation rock in the middle part of the dam or the river bed in the Iran section, have high to medium permeability (LU=10 to 60) to the depth of 25 meters below the grouting gallery. By increasing depth, permeability is decreased and below 35 meters of depth, the foundation rock becomes impermeable. In the Turkmenistan section, to

the depth of almost 40 meters, it has medium (LU=10 to 30) to very high (LU>60) permeability and below that depth, it starts decreasing such that below 50 meters, permeability is decreased to values lower than 3 Lugeon.

Rock quality designation (RQD)

Analysis on cores recovered from first and second phase of excavations in Doosti Dam shows that the specific rock mass quality in lithological units of dam foundation area decreases near surface and apart from the fault paths, increases in the depths. Table 2 shows RQD values for different parts of the Doosti Dam site.

Grout curtain of doosti dam

Construction of grout curtain by injection is one of the common methods of maintaining the hydraulic stability of earth dams to prevent leakage and internal erosion of dam foundations. Grout curtain of Doosti Dam is 1125 m long, from which 335 meters is in right abutment and open space, approximately 225 m in the foundation or bedrock and 535 m in the left abutment to the end of spillway entrance platform. Specifications and longitudinal section of Doosti Dam grout curtain are presented in Table 3 and figure 5 respectively.

Assessment of grout curtain

Right abutment and open space

There are various quality assessment methods for grout curtain injection. One of these methods is the amount of cement loss in grout curtain borehole rows. Based on this, it is essential to have a criteria for cement loss assessment. In this research, Deere (1982) descriptive classification with minor modifications was used for cement loss classification and comparison in different injection sections is showen in Table 4.

Iso-cement take curves

Based on the cement loss data, iso-cement take curves were drawn by Surfer as shown in figure 6. Based on this figure, exact location of points with high cement take was determined and cement take variations in different rows were compared. Finally, successful injection operation decreased the foundation rock permeability and increased the efficiency of grout curtain in the designated areas.

As shown in figure 6, assessment of iso-cement take curves in the first row of grout curtain in the right side indicate that there are numerous areas with medium to high cement take. These areas are located in the right abutment in grouting gallery to the depth of 15 meters and in the open space to the depth of 40 m. A linear zone with 100 meters of depth is observed at the end of grouting gallery in the right abutment with very high cement take which have high cement take in the next two rows as well.

Cement take in the second row boreholes in the right abutment and open space are decreased significantly (less than 50 kg/m). However, there are still points with medium to high cement take that are mostly located in the open space.

In the additional row boreholes, cement take in most of the points in the right abutment and open space are decreased to very low values (less than 12.5 kg/m). Linear zone at the end of grouting gallery and another zone in open space still have medium to high cement take. These zones are weak points and have the potential to transfer reservoir water to the downstream. Finally, the amount of rock cement take in the right side is decreased by implementing continuous rows of grout curtains.

Foundation or river vally

In the middle part of the Doosti Dam, three rows of boreholes were excavated and grouted from inside of the grouting gallery. shows iso-cement take curves of the grouting curtain boreholes in the middle part of the dam and the following results were obtained(Figure 7) .

In the first row boreholes of the grouting curtain (vertical boreholes), most of the cement take were in surficial parts below the grouting gallery to 10 m depth. Cement take is Iran section of the dam is more than the Turkmenistan section.

Cement take was substantially decreased in the second row boreholes. In both sides of water diversion gallery, besides from a few sections, the cement take was below 50 kg/m. This decrease in cement loss shows the success of the first row of grouting.

In the additional row, cement take in the rock units on the right side of water diversion gallery reached to less than 50 kg/m. However, in the left side, with the increase in the boreholes angles, there were points with medium to high cement take. Appearance of these points was due to the high angle of boreholes compared to the Turkmenistan section.

Left abutment and spillway

Left abutment and spillway of Doosti Dam are located on the fine grained calcareous sanstones, siltstones with interlayers of marl and argillite and calcareous marls of Abtalkh formation with very low permeability. Therefore, grout curtain in this part is implemented in one row and to the maximum depth of 20 meters. Figure 8 shows iso-cement take curves in this part.

As depicted in this figure, cement take in the left abutment in most of the points is below 50 kg/m. In the spillway part, there is more cement take which is mainly due to the surficial weathered joints, but in the depth the rock is impermeable.

Control boreholes

After implementation of the grout curtain, control boreholes were excavated to assess its performance. These boreholes were dug with angles 10 to 40 degrees from vertical towards south and then 15-minute Lugeon tests were conducted inside them. Then they were grouted and the results were presented as the iso-cement take curves as depicted in figure 9.

As depicted in figure 9, in most parts of the grout curtain, the cement take is reduced to less than 50 kg/m. The only place with high permeability and high cement take was some part of the foundation in the Iran section and the open space in the right side where there was contact with the lake. This has caused water escape and other problems in the operation of the dam.

RESULTS AND CONCLUSION

Doosti Dam site is composed of various formations with different hydrogeological characteristics. Based on Lugeon tests left abutment, spillway and a part of the dam foundation in Iran section have no water escape potential due to

the Abtalkh formation containing marls and siltstone. Neyzar, Kalat and Pesteligh formations under the right side of the dam have great potential for reservoir's water transfer through bedding surfaces and joints.

The left abutment of the dam is impermeable and in maximum have very low permeability from near surface to the depth of 5 meters (LU<3). The foundation rock under the spillway to the depth of 10 meters have low permeability (LU=3 to 10) and after that becomes impermeable. The foundation rock in the middle part of the dam to the depth of approximately 40 meters have medium (LU= 10 to 30) to very high (LU>60) permeability. By going deeper permeability decreases, and deeper than 50 meters it reaches values less than 3 LU. Rock units in the right abutment to the depth of 25 meters below the grouting gallery have medium to very high permeability. Below this depth the permeability decreases with few exceptions where the rocks still have high permeability (LU>60). In rock units outside the dam body in Turkmenistan section, permeability is low (LU=3 to 10) to a maximum depth of 15 meters and after that the rock becomes impermeable (LU<3).

Grout curtain in the right abutment and foundation of the dam include 2 main and one additional rows which were implemented from grouting tunnel and gallery. The curtain is extended to the open space in the right side in a single row and in 3 stages with different distances. Grout curtain in the left side of the dam and in the left abutment is built in one row from grouting gallery and continued to the spillway part in the open space. Generally, the cement loss in the right side and foundation of the dam is much higher than the left side.

In the right abutment and open space grout curtain, there is no coordination between Lugeon results and cement loss. Points with medium to high cement take in the foundation and open space control logs show that there are still zones with permeabilites higher than 3 LU after the implementation of the grout curtain. These points are pathways for water escape and pose risk on dam's stability during operation which mandates a re-grouting program.

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Table 1. Geometrical properties of discontinuities in Doosti Dam site

Right abutment				Left abutment and River Bed				Location
J3	J2	J1	Bedding	J3	J2	J1	Bedding	Discontinuity
114	214	278	014	117	197	278	011	Dip Direction (deg.)
66	64	70	64	51	68	43	63	Dip (deg.)

Table 2. Rock Quality Designation for Doosti Dam site (Tooss Ab Consulting Engineers, 1999).

Lithology	Number of Fractures in Length Unit F/m	Rock Quality	RQD %	Location	
Sandstone, Sandy Limestone, Siltstone with thin Argillitic layers	6	Fair	60	Right Abutment	
Siltstones with interlayers of Marl and Sandstone	3	Fair	71	River Bed	
Argillitic and Marl Rocks	6	Fair	66	Upper	Left Abutment
	3	Good	85	Lower	
Marl	2	Fair	72	Spillway	

Table 3. Specification of grout curtain boreholes in Doosti Dam

Left abutment and spillway	**Foundation or middle part**			**Right abutment and grouting gallery**				**Open space in right side**	**Location**
First Row	Additional row	Second row	First row	Additional row	Second row	First row		First row	
Zero 30E Series	40, 30	30, 20	zero	30, 18	18	5	Right abutment	5-37	Inclination of boreholes (deg.)
				30	zero	zero	Grout gallery		
3895	2437	5007	3793	1865	4182	3949		12531	Total Drilling Length (m)
20	50			80				100	Max Borehole Depth (m)

Table 4. Proposed grout consumption classification

Very high				**High**	**Relatively high**	**Medium**	**Relatively low**	**Low**	**Very low**	**Description**
10000-500000	4000-10000	1000-4000	400-1000	200-400	100-200	50-100	25-50	12.5-25	<12.5	Cement Take (kg/m)

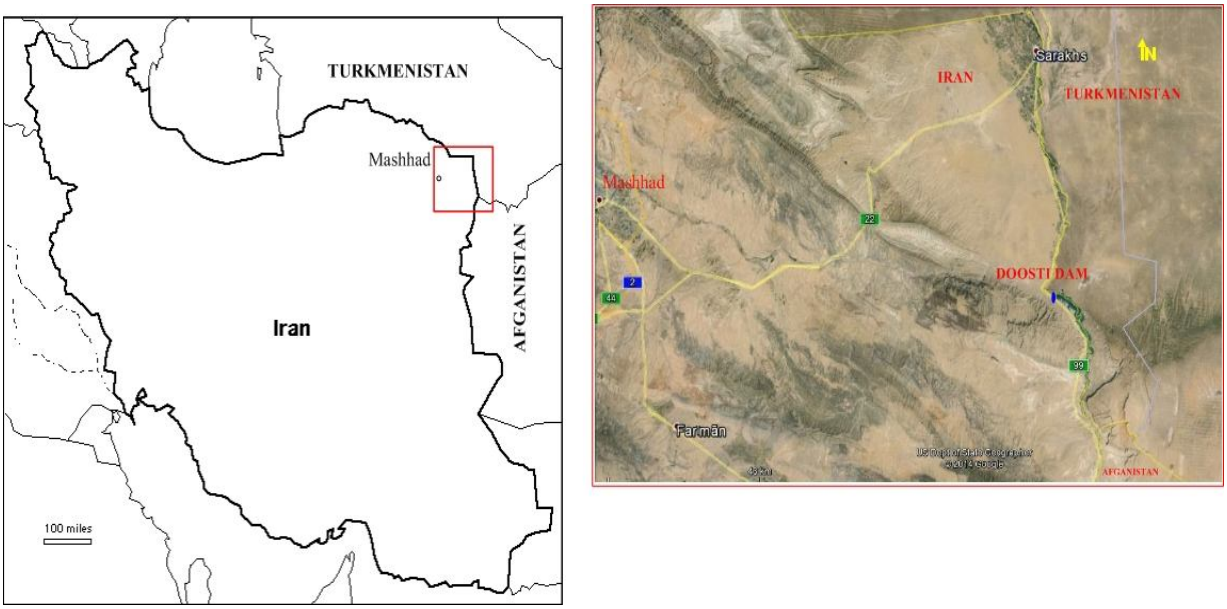

Figure 1. Geographical location of doosti dam and access routes

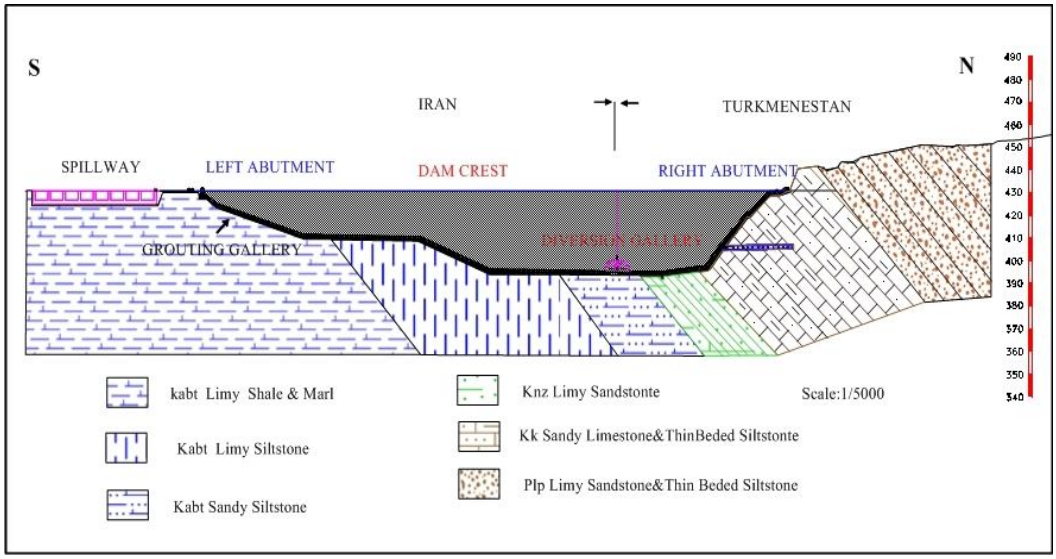

Figure 2. Geological profile along the dam axis

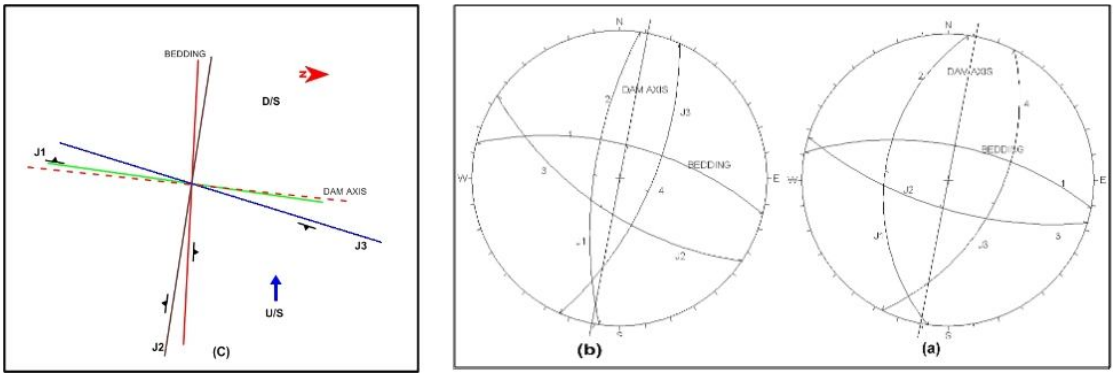

Figure 3. Geometrical properties of discontinuities in dam site (a) right side(b) foundation & left side and (c) discontinuities position with dam axis

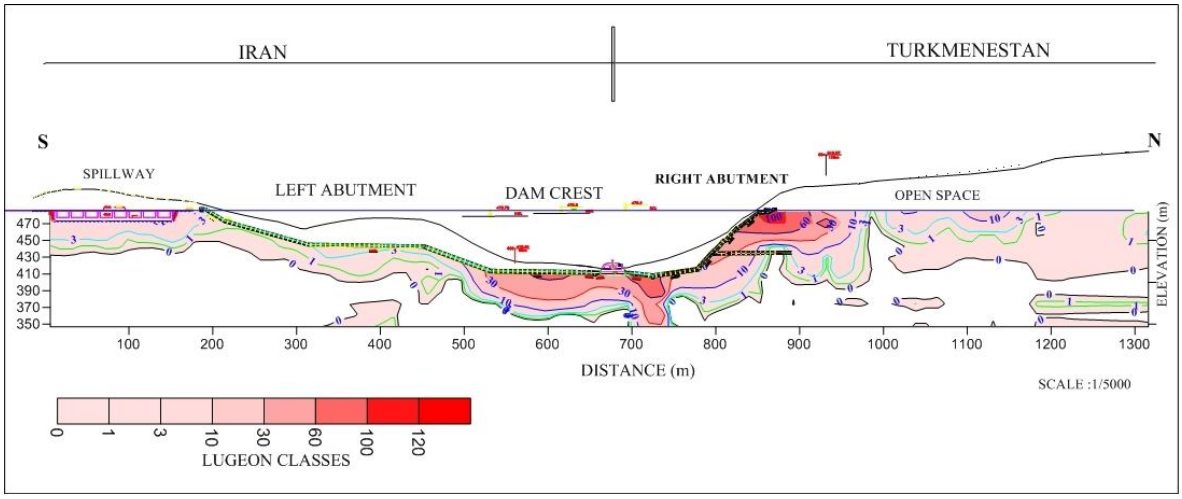

Figure 4. Lugeon value iso-lines along axis of doosti dam

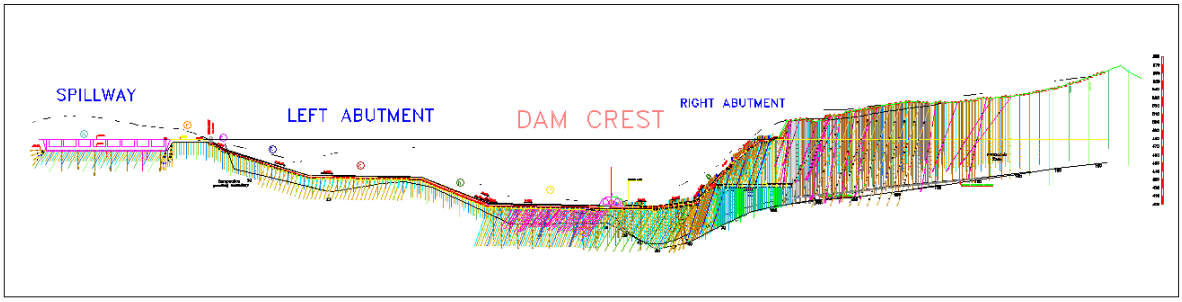

Figure 5. Grout curtain borehole arrangement in doosti dam (culham co. 1999)

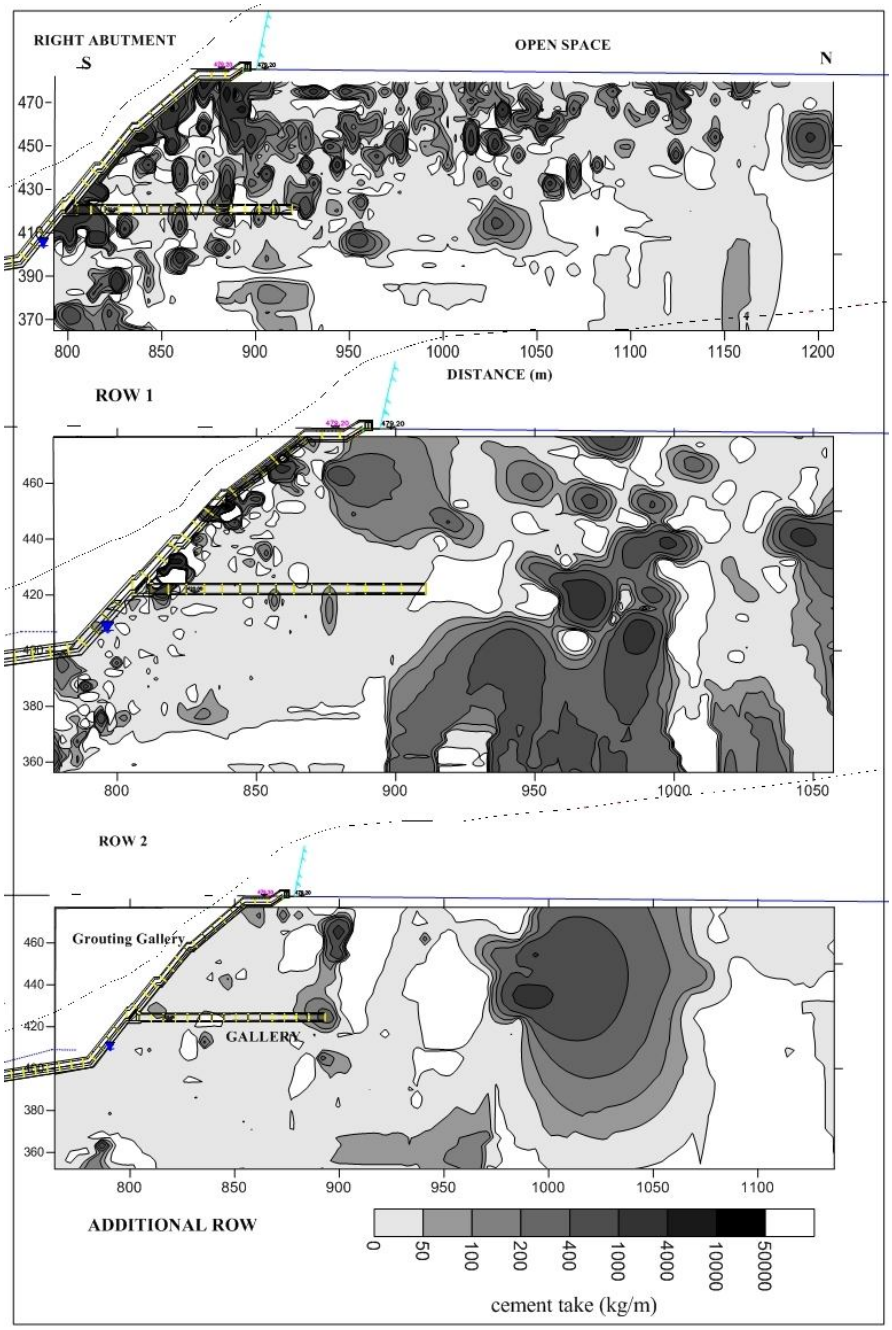

Figure 6. Iso-cement take curves of the right abutment of doosti dam in the first, second and additional rows.

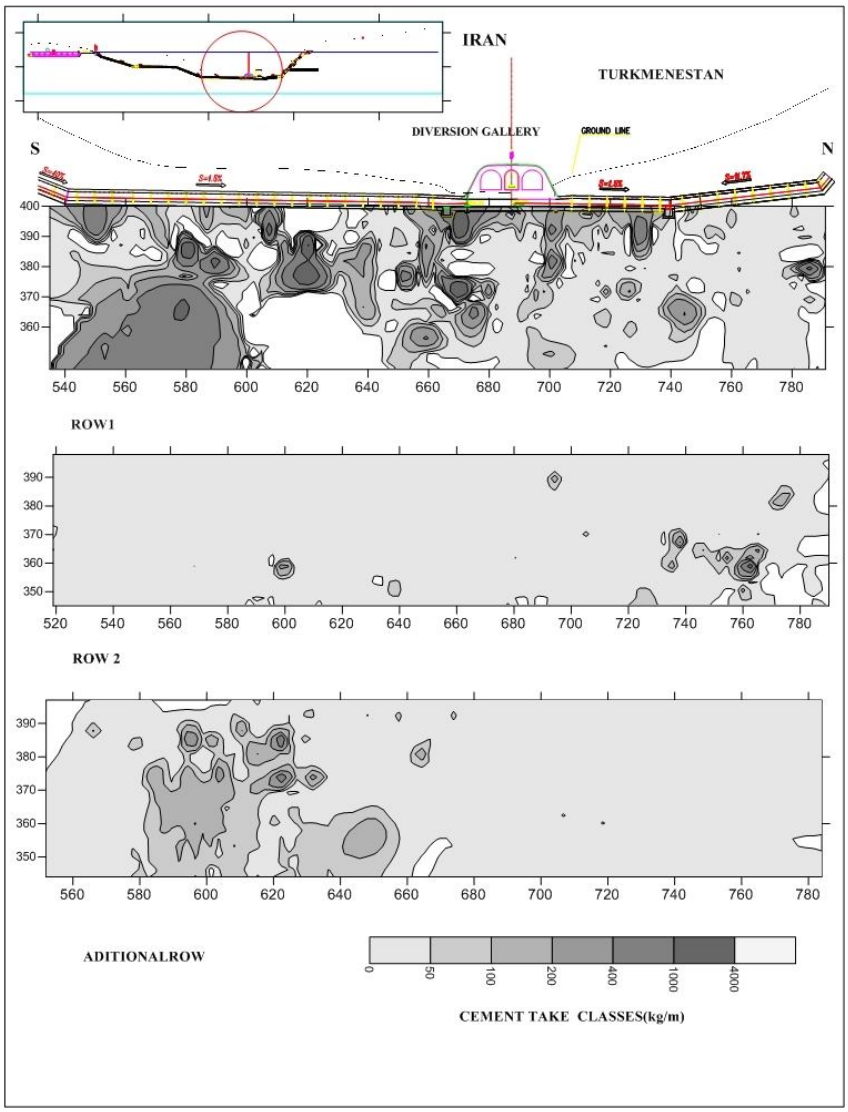

Figure 7. Iso-cement take curves of the grouting curtain in the middle part of the dam

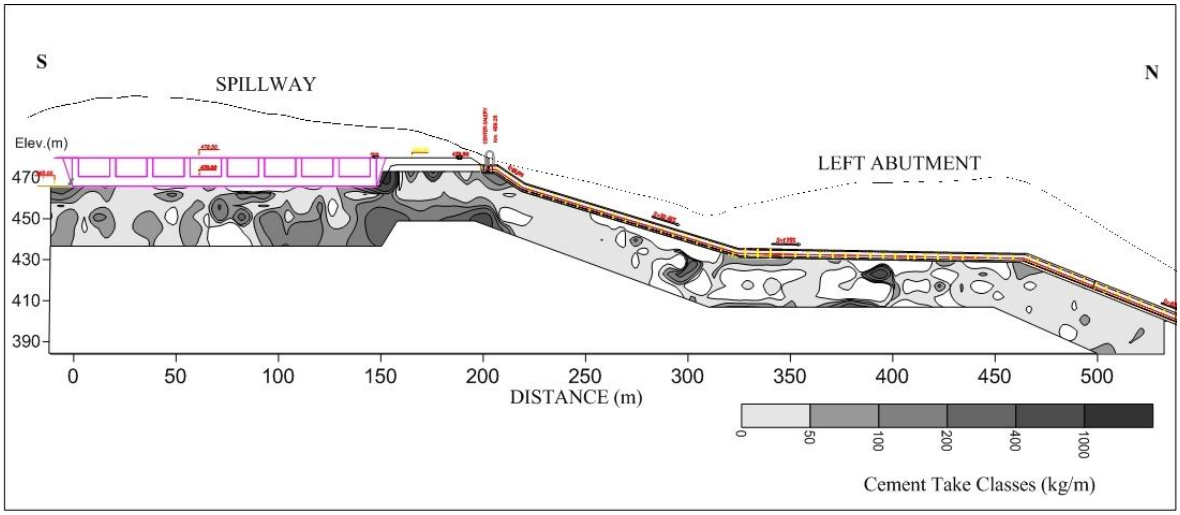

Figure 8. Grout curtain iso-cement take curves in the left abutment and spillway

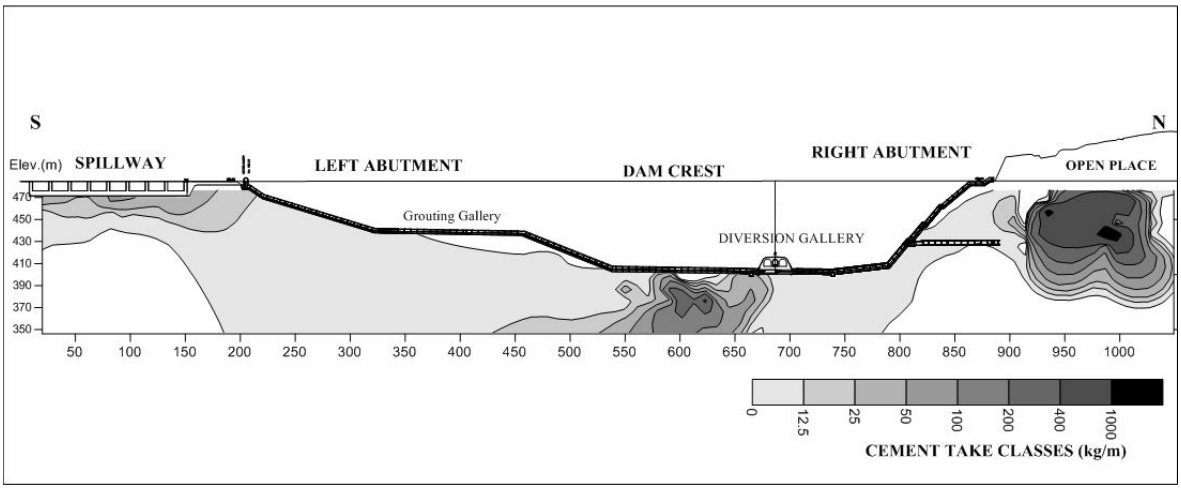

Figure 9. Iso-cement take curves in control boreholes

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RESEARCH ARTICLE

Study and Spatial Analysis of the Relationship between the Madden-Julian Oscillation and Precipitation in Iran

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ABSTRACT

This study was aimed to determine the relationship between the Madden–Julian Oscillation (MJO) and monthly total precipitation of October–June over Iran within 1979–2002. For this purpose, diurnal percentage of positive and negative MJO index was scaled based on the monthly data. Then, the correlation coefficients between precipitation and MJO positive and negative phases were calculated and interpolated across the country applying Inverse Squared Distance Weight (IDW) for all stations. The results revealed a significant diverse correlation ($P \leq 0.05$) between precipitation and both MJO phases. On this basis, monthly precipitation was statistically increased during the MJO negative phase and vice versa for the positive phase over Iran. The MJO negative phase and precipitation represented a significant correlation during February equal to -0.69% ($P \leq 0.01$). In general, The MJO influences the southern and western Iran during January and February, northern and eastern Iran during March, April, May and November, and no significance in June, October, and December. This feature seems to be related to the position of the subtropical downdrafts from the ITCZ. Since, the ITCZ is situated on higher latitudes and southern Iran is placed under the subtropical high pressure (STHP) in warm seasons. Hence, the correlation between precipitation and MJO to be weakened contributed to reduction in precipitation.

Key words: Madden–Julian Oscillation, precipitation, Spatial Analysis, Iran

INTRODUCTION

The tropical atmosphere-ocean system in addition to variability in annual timescale that attributed to the El Nino-Southern Oscillation (ENSO), indicates diversity on the smaller timescales (Madden and Julian, 1971; Madden and Julian, 1972). The Madden–Julian oscillation (MJO) with intraseasonal timescales (30–60 days) is the prevalent mode in the tropical atmosphere (Madden and Julian, 1994). MJO appears in Seasonal variability of convection (Weickman et al., 1985; Wheeler and kiladis, 1999; Sajani et al., 2007). In addition to the Madden Julian Oscillation in the lower and upper troposphere, in the near-surface layer and above the ocean these fluctuations can also be seen in the surface winds, surface heat balance, sea surface temperature and ocean currents (Lau and Philip, 1986; Ferranti et al., 1990; Hsu, 1996). The MJO is a slow eastward propagation of atmospheric disturbances with maximum amplitudes in the Eastern Hemisphere (Wang and Rui 1990; Hayashi and Golder 1993; Hendon and Salby 1994).The Asian-Australian monsoon system is strongly in influenced by the MJO events (e.g., Yasunari 1979; Lau and Chan 1986; Krishnamohan et al. 2012; Zhang et al., 2007; Fan et al., 2013). The interaction of the MJO with the extra-tropical regions has been shown to influence weather forecasts on medium-to-extended range (Ferranti et al. 1990; Lau and Chang 1992; Oliver 2014). Furthermore, coupling with the tropical ocean via westerly wind bursts associated with the passage of an MJO significantly modify sea surface temperature (Liu et al. 2014), surface heat fluxes (Kawamura 1998; Zhang 1996; Jones and Weare 1996; Flatau et al. 1997; Jones et al. 1998; Hendon and Glick 1997; Liu et al. 2012) and the structure of the thermocline in the equatorial Pacific Ocean (Kessler et al. 1995). This latter interaction has even been suggested to play an important role in triggering ENSO events (e.g., Lau and Chan 1986; Weickmann 1991). As well, numerous studies have been carried out on the impacts of the Madden-Julian oscillation on the precipitation (e.g. Bond and Vecchi 2003; Wheeler and Hendon 2004; Donald et al. 2006). Barlow et al. (2005) indicated that MJO activity in the eastern Indian Ocean has a considerable influence on the precipitation of SW Asia during November–April. They also showed that the MJO modifies both the local jet structure and, through changes to the thermodynamic balance, the vertical motion field over Southwest Asia, consistent with the observed modulation of the associated synoptic precipitation. Also, Nazemosadat and Ghaedamini (2010) investigated the effects of the MJO on November–April precipitation in both southern parts of Iran and the Arabian Peninsula for the period of 1979–2005. They showed that Seasonal precipitation and the frequency of wet events were increased during the negative Phase. They also proved that during the negative MJO phase, while enhanced low-level southerly winds transfer a substantial amount of moisture to the southern parts of Iran, upward motion increases in the middle layers of the atmosphere. Synchronized with the prevalence of these rain-bearing southerly winds, the existence of a strong horizontal wind speed gradient at the exit region of the North Africa–Arabian jet enhances precipitation. The study of precipitation variability and MJO positive and negative phases across Iran, as the main goal of this study, was not considered by Nazemosadat and Ghaedamini (2010). Also, the spatial analysis of the relationship between precipitation and MJO was not the theme of their investigation. Hence, the purposes of this study are to determine and spatial analysis of the relationship between the Madden–Julian oscillation (MJO) and monthly total precipitation from October–June in whole of Iran for the period of 1979–2002.

MATERIALS AND METHODS

Study area

The study area of this research is Iran with an area of 1,648,195 km2 which is located between 25° and 40° north latitude and 44° and 63° east longitude (Fig. 1). The complex physical conditions of Iran including topography, vegetation cover and landscape have created a diverse climate pattern (Alijani 2008). The direction of major mountains of Iran, the Alborz (mountains in the north) and the Zagros (in the west and south), adjacent to the hot and arid Saudi Arabian deserts, and its distance from the oceans is the most important reasons for Iran various

climates (Ashraf et al. 2013). Therefore, Iran varies in climatic conditions from arid to humid across the country. Iran is located in mid latitude dry zone where rain is the only assured renewable water source (Zarenistanak et al. 2014). The annual precipitation of the different regions of Iran varies from 0 to 2,000 millimeters. The highest rate of annual precipitation belongs to the Caspian Sea coastal areas (Alijani et al. 2008b). As well, the lowest rate of annual rainfall takes place in the central desert region (Alijani and Harman 1985; Alijani 2002). Generally, precipitation in Iran is highly variable in both space and time.

Weather and MJO data

The Madden–Julian oscillation data used in this study were obtained from NOAA CPC through their data archives (http://www. cpc.ncep.noaa.gov). These data is calculated on a daily basis by the Centre for Australian Weather and Climate Research based on the method of Wheeler and Weickman (2001) for the period of 1979-2002. As well, daily precipitation data for 48 synoptic stations in Iran were obtained in the quality controlled format from the Meteorological Organization of Iran (IRIMO) via (http://www.irimo.ir) for the same period. Stations characteristics are shown in Table 1 and their distribution is mapped in Fig. 1. In this method Outgoing longwave radiation (OLR) daily data that with a period of 30 to 96 days with a wavelength 1-5 Propagated to the east have been filtered. Then, the average of these data in a region with a length of 80° to 100° Eastern longitude and a width of 15° southern Latitude to 10° northern latitude as MJO index is calculated.

The relation between MJO and monthly precipitation

Since the effects of Madden-Julian Oscillation as a teleconnection index can be delayed for several days and also in order to filtering of high-frequency wave patterns, monthly data was used. Since the MJO data based on the method of Wheeler and Weickman (2001) are only available on a daily basis, to form the monthly database, the percentage of days with positive and negative MJO index in each month was calculated. In other words, each month of the study period (1979–2002) was determined as a positive or negative MJO phase if, for at least 60% of the days of that month the MJO index was positive or negative, respectively (Nazemosadat and Ghaedamini, 2010). For instance, in December 2000, from 31 days, 8 days MJO index was positive with 26% And 23 days index was negative. This indicates that 76% of the month, MJO index was negative. MJO index for months that the percentage of the each positive and negative phase was less than 60 percent was considered to be zero (Table 2). Afterwards, to evaluate the effect of MJO on precipitation of Iran a matrix consists of 48 rows and 9 columns that indicate the total monthly precipitation of 48 synoptic stations of Iran were created for months of January, February, March (winter), April, May, June (spring), October, November and December (fall) for the period 1979-2002. It should be noted that since the summertime precipitation of Iran is not considerable, this season was ignored. After Data preparation, the correlation coefficient between total monthly precipitation and MJO positive and negative phases were calculated for all stations.

Spatial analysis of relationship between precipitation and MJO

Since the results were based on the point data of 48 stations, there were no values for the extensive areas between the stations. Hence, a layer with the point format was developed in the ArcGIS environment according to the geographical coordinates of the stations. Then, the relation between MJO and monthly precipitation (The correlation results) for each of months were tabulated in this layer. The tabulated values of the stations points were interpolated to the whole country through the implementation of the squared inverse distance weight (IDW) interpolation procedure (Alijani et al. 2008a). This procedure showed the least Root Mean Square Error (RMSE). Finally, the digital map layers for the entire Iran were produced that depict spatial distribution of the correlation between total monthly precipitation and MJO for all the investigated months.

RESULTS AND DISCUSSION

In January, the highest relationship between precipitation and Madden-Julian oscillation were found in Bandar Lengeh, Chabahar, Kish Island and Bandar Abbas in the southeastern part of Iran equal to 53% ($P \leq 0.01$), 53% ($P \leq 0.01$), 51% ($P \leq 0.01$) and 50% ($P \leq 0.01$) as the moderate correlation coefficient, respectively (Table 3). On the other hand, the lowest correlations have been achieved for Hamedan, Tabriz and Gorgan in the north of Iran. As the spatial distribution map of the correlation shows, the highest correlations were observed in the Sistan-Baluchestan province, Kerman, Hormozgan, Fars and also small areas of the Southern West and west of Iran, respectively, and the lowest correlation was found in the center of the country (Fig. 3a). In February compared to January higher relationship was found between precipitation and Madden-Julian oscillation, So that more than 30% of the stations represented strong correlation in Abadeh, Yazd, Chabahar, Bandar Abbas with a correlation coefficient of -0.69 ($P \leq 0.01$), -0.67 ($P \leq 0.01$), -0.66 ($P \leq 0.01$) and -0.62 ($P \leq 0.01$), respectively (Table 3). As well, lowest correlation was found in the Babolsar, Noshahr, Ramsar and Gorgan. Southern provinces of Caspian Sea demonstrate slightly relation (Fig. 3b). As shown in Fig 3.c, the only significant correlation in March was observed in Rasht equal to 47% ($P \leq 0.05$).

As shown in Fig. 3a, the most relationships in April belongs to Hamadan, Tabas, Urmia and Gorgan equal to 59% ($P \leq 0.01$) and 53% ($P \leq 0.05$), 49% ($P \leq 0.01$) and 47% ($P \leq 0.05$) respectively and the lowest correlations were observed in Chabahar, Bandar Abbas and Bandar Jask. Southern areas of Iran by logging into warm period of the year show the lowest correlation. In the May such as March moderate correlation between total monthly precipitation and MJO was observed. Tabriz, Kish and Bushehr with correlations of 44% ($P \leq 0.05$), 42 % ($P \leq 0.05$) and 41% ($P \leq 0.05$) demonstrated the highest relationship, respectively. The lowest correlations belong to Yazd, Isfahan and Birjand. In the Southern east of the Iran where the winter showed the highest relationship between precipitation and MJO, in the warm period of the year has represented the lowest correlation. The highest correlation was observed in the provinces of East Azerbaijan and Bushehr (Fig. 3.b). In June, there was no significant correlation between precipitation and Madden-Julian oscillation (Table 3). Nevertheless, the highest and lowest relationships were observed in Zahedan and Saghez, respectively (Fig. 3.c).

As shown in Fig. 4.a, In October, the same as last month was not observed a significant relationship between MJO and monthly precipitation and the highest and lowest relationships were obtained in Khorramabad and Ahvaz, respectively. In other words, the highest correlation of this month was seen in West, Central and North East of Iran and the lowest correlation were found in the South East of country. In November, the intertropical convergence zone (ITCZ) has moved to the southern hemisphere and the southern half of Iran comes out of under subtropical high-pressure. Hence, increase in relationship between the monthly precipitation and MJO was observed in the southern areas of Iran. Thus, Zabol, Dezful and Iranshahr with correlations of -0.54 ($P \leq 0.01$), -0.51 ($P \leq 0.05$) and -0.49 ($P \leq 0.05$) showed the highest relationship, respectively. On the other hand, Zanjan, Isfahan and Bam showed the lowest relations, respectively (Fig. 4.b). In December, it was not found a significant correlation between total monthly precipitation and Madden-Julian oscillation and the highest relationship was observed in southern west of Iran (Fig. 4c).

CONCLUSION

The relationship between the Madden–Julian oscillation (MJO) and monthly total precipitation of October–June over Iran was investigated within 1979–2002. Since the MJO data based on the method of Wheeler and Weickman (2001) are available only on a daily scale, to form the monthly database, the percentage of days with positive and negative MJO index in each month was calculated. Finally, the positive and negative phase of the MJO was determined on a monthly scale. After data preparation, the correlation between total monthly precipitation and MJO positive and negative phases were calculated for all stations. The results showed a negative correlation ($P \leq 0.05$) between precipitation and the MJO negative and the positive phases. However, the MJO negative phase and precipitation

represented a higher significant relationship. The correlation fluctuated from low (20-40) to strong (60-80) in different months and stations. For spatial analysis of the relationship between precipitation and MJO, The tabulated values of the stations points were interpolated to the whole country through the implementation of the squared inverse distance weight (IDW) interpolation procedure. The results indicated that In January, the highest correlations between precipitation and Madden-Julian oscillation were found in the South of Iran such as Bandar Lengeh equal to -53% ($P \leq 0.01$), Chabahar -53% ($P \leq 0.05$), Kish Island -51% ($P \leq 0.05$) and Bandar Abbas -50% ($P \leq 0.05$) as the moderate correlation coefficient, respectively. In February compared to January higher correlation was found between precipitation and MJO, So that more than 30% of the stations represented a strong correlation in Abadeh, Yazd, Chabahar and Bandar Abbas with a correlation coefficient of -0.68 ($P \leq 0.01$), -0.67 ($P \leq 0.01$), -0.66 ($P \leq 0.01$), and -0.62 ($P \leq 0.01$), respectively. On the other side, Northern provinces of Iran demonstrated a low correlation. The only significant correlation in March was observed in Rasht equal to 47% ($P \leq 0.05$) in the north of Iran. In the Southern east of Iran where the winter showed the highest, the spring has represented the lowest correlation. The most relationship in April belongs to Hamadan and Tabas equal to 59% ($P \leq 0.05$) and 52% ($P \leq 0.05$), respectively and the lowest correlation was observed in Bandar Chabahar, Bandar Abbas and Bandar Jask. Such as March, southern areas of Iran showed the lowest correlation. In May, moderate correlation between total monthly precipitation and MJO was observed. As well, the north east of Iran showed the highest dependence in June. The highest correlation of October was seen in West, Central and North East of Iran and the lowest correlation were found in the South East of country. In November, increase in relationship between the monthly precipitation and MJO in the southern areas of Iran was observed again so that Zabol, Dezful and Iranshahr showed the high correlation of -0.54 ($P \leq 0.05$), -0.50 ($P \leq 0.05$) and -0.48 ($P \leq 0.05$), respectively. The highest relationship in December was observed in Abadan. Totally, it can be stated that in the southern areas of Iran where the winter showed the highest correlation between precipitation and MJO, in the warm period of the year with the rising of intertropical convergence zone (ITCZ) and placement of southern areas of Iran under Subtropical high pressure (STHP) due to a reduction in precipitation was not observed a high dependence between precipitation and MJO in these areas (Fig. 5). Nazemosadat and Ghaedamini (2010) also demonstrated that the MJO negative phase enhances seasonal (November–April period) precipitation over the southern areas of Iran from about 10% to 70% and Southern Iran and the Arabian Peninsula are mostly engulfed by a dry northerly airflow during the positive MJO phase. Because of the suppression in moisture transport, the study area encounters an intense dry event during this phase. The highest and lowest correlation between Madden-Julian Oscillation and the precipitation in Iran was observed in February and June, respectively.

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Table 1. Longitude, Latitude, Elevation, and Annual Average of Precipitation for 48 Study Locations of Iran

Station	Longitude (E)	Latitude (N)	Elevation (M)	Total precipitation (mm)
Abadan	48.27	30.35	7	153.3
Abadeh	52.65	31.16	2030	137
Ahvaz	48.68	31.32	23	209.2
Arak	49.69	34.10	1708	337.1
Ardabil	48.30	38.25	1332	295.5
Babolsar	52.65	36.70	-21	889.3
Bam	58.35	29.10	1067	58.8
Bandar Abbas	56.28	27.19	10	176.1
Bandar Anzali	49.47	37.47	-26	1830.5

Bandar Jask	57.77	25.65	5	139.3
Bandar Lengeh	54.88	26.56	23	136.9
Birjand	59.22	32.86	1491	168.5
Bojnourd	57.33	37.47	1091	267.8
Boushehr	50.84	28.97	20	268
Chabahar	60.65	25.29	8	118
Dezfoul	48.40	32.38	143	394.6
Esfahan	51.65	32.68	1551	125
Fasa	53.65	28.94	1288	289.9
Gorgan	54.44	36.84	13	583.8
Hamedan	48.51	34.80	1742	317.7
Iranshahr	60.69	27.21	591	111.9
Kashan	51.45	33.96	982	136
Kerman	57.08	30.29	1754	148
Kermanshah	47.07	34.32	1319	439.2
Khoram Abad	48.36	33.50	1148	504.3
Khoy	44.95	38.55	1103	289.2
Kish	54.00	26.55	30	169.6
Mashhad	59.54	36.29	999	251.5
Noshahr	51.51	36.65	-21	1272.8
Ghazvin	50.00	36.31	1279	314.4
Ramsar	50.64	36.92	-20	1206.2
Rasht	49.59	37.28	-7	1337.5
Sabzevar	57.68	36.21	978	186.6
Sanandaj	47.00	35.32	1373	449.9
Saghez	46.27	36.24	1523	487.2
Semnan	53.39	35.58	1131	140.7
Share Kord	50.86	32.33	2049	321.8
Shahroud	54.97	36.42	1345	153.3
Shiraz	52.53	29.62	1484	334.7
Tabas	56.93	33.60	711	82.2
Tabriz	46.29	38.08	1361	283.8
Tehran	51.35	35.66	1191	232.7
Torbat Heidarieh	59.22	35.27	1451	267.7
urmia	45.07	37.55	1316	338.9
Yazd	54.37	31.90	1237	59.2
Zabol	61.50	31.03	489	57.7
Zahedan	60.87	29.50	1370	89.3
Zanjan	48.48	36.67	1663	311.1

Table 2 .The Years During Which Monthly MJO Was Either In Positive Or Negative Phase.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Oct.	Nov.	Dec.
1979	negative	positive	0	negative	positive	positive	negative	positive	negative
1980	positive	negative	positive	positive	negative	positive	positive	0	positive
1981	positive	positive	negative	0	negative	negative	negative	positive	negative
1982	positive	negative	positive	0	negative	positive	negative	negative	positive
1983	positive	positive	negative	positive	positive	positive	negative	positive	negative
1984	positive	positive	negative	positive	negative	positive	0	0	positive
1985	negative	positive	negative	positive	negative	positive	negative	positive	negative
1986	positive	negative	positive	negative	negative	positive	negative	0	positive
1987	positive	0	positive	0	positive	positive	negative	positive	negative
1988	negative	negative	positive	negative	positive	negative	negative	positive	negative
1989	positive	positive	negative	positive	positive	negative	positive	positive	0
1990	positive	negative	negative	positive	positive	positive	negative	0	0
1991	negative	positive	negative	positive	negative	negative	positive	negative	0
1992	negative	positive	negative	negative	0	positive	positive	negative	positive
1993	positive	negative	positive	negative	negative	negative	0	positive	positive
1994	negative	positive	positive	negative	negative	positive	negative	negative	0
1995	positive	positive	0	negative	positive	positive	negative	positive	negative
1996	negative	positive	negative	0	negative	0	positive	negative	positive
1997	negative	positive	negative	negative	positive	negative	negative	negative	positive
1998	negative	positive	negative	negative	positive	negative	negative	positive	0
1999	negative	negative	positive	positive	positive	negative	positive	negative	0
2000	0	positive	negative	positive	negative	negative	positive	positive	negative
2001	negative	positive	negative	negative	negative	positive	negative	positive	negative
2002	0	positive	0	negative	0	negative	-	-	-

Table 3. Stations with the highest correlation coefficient between the madden-julian oscillation and total monthly precipitation during the months of october–june

station	January		station	February		station	March	
	Correlation	Sig.		Correlation	Sig.		Correla -tion	Sig.
Bandar Lengeh	-0.53	0.008	Abadeh	-0.69	.000	Rasht	-0.47	0.021
Chabahar	-0.53	0.014	Yazd	-0.67	.000	Babolsar	-0.30	0.159
Kish Island	-0.51	0.012	Chabahar	-0.66	0.001	Khoy	-0.29	0.162
Bandar Abbas	-0.50	0.012	Bandar Abbas	-0.62	0.001	Shahrud	-0.27	0.167
station	April		station	May		station	June	

	Correlation	Sig.		Correlation	Sig.		Correlation	Sig.
Hamedan	-0.59	0.002	Tabriz	-0.44	0.031	Zahedan	-0.30	0.152
Tabas	-0.53	0.024	Kish	-0.42	0.039	Shahrud	-0.28	0.158
Urmia	-0.49	0.015	Bushehr	-0.41	0.054	Tabas	-0.27	0.160
Gorgan	-0.47	0.020	Rasht	-0.37	0.076	Kish	-0.24	0.169

station	October		station	November		station	December	
	Correlation	Sig.		Correlation	Sig.		Correlation	Sig.
Khorramabad	-0.34	0.118	Zabol	-0.54	.007	Abadan	-0.40	0.061
Babolsar	-0.31	0.144	Dezful	-0.51	.019	Bam	0.40	0.061
Kerman	-0.31	0.152	Iranshahr	-0.49	0.021	Arak	-0.36	0.090
Tabas	-0.31	0.230	Tabas	-0.48	0.051	Khorramabad	-0.34	0.115

Bold numbers are the significant correlations

Correlations are significant at the 0.01and 0.05 level (2-tailed)

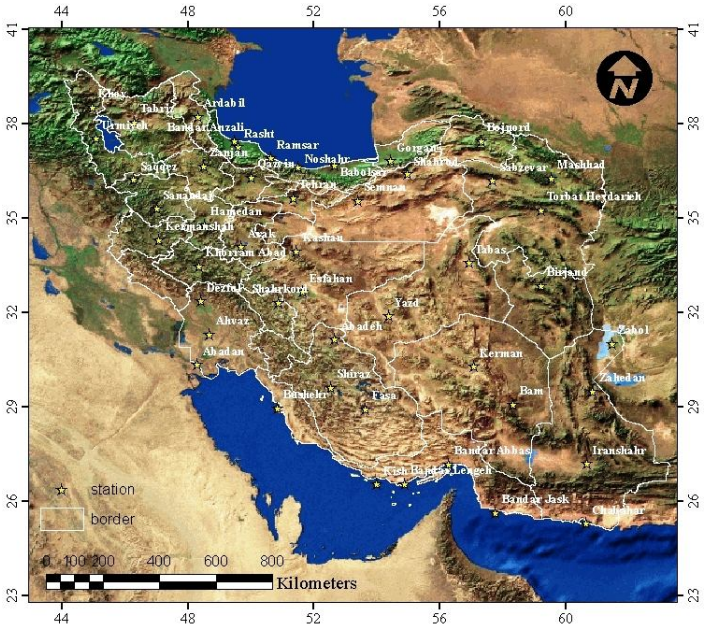

Fig. 1. Geographical distribution of the 48 study locations of Iran

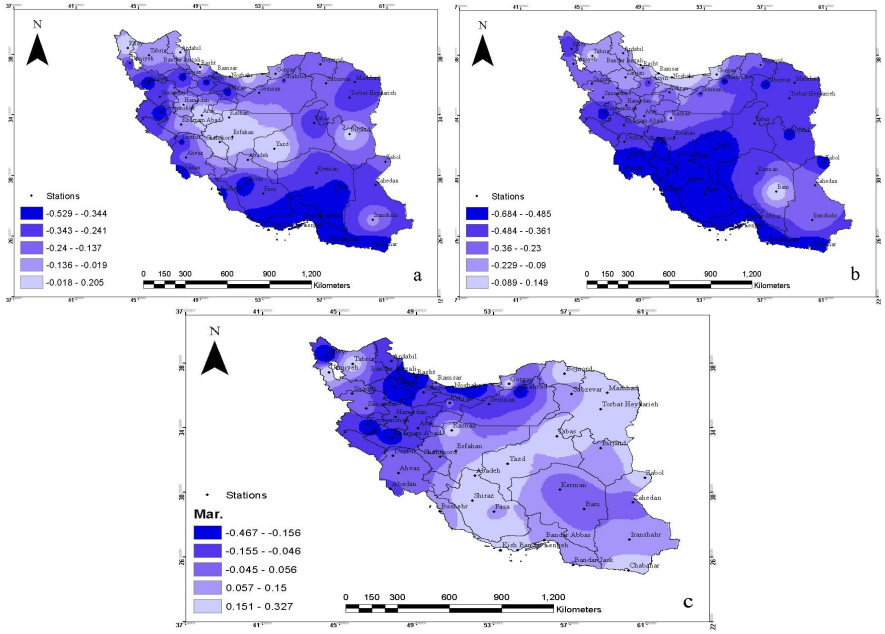

Fig. 2 .Spatial distribution of the correlation between total monthly precipitation and MJO for (a) January, (b) February and (c) march

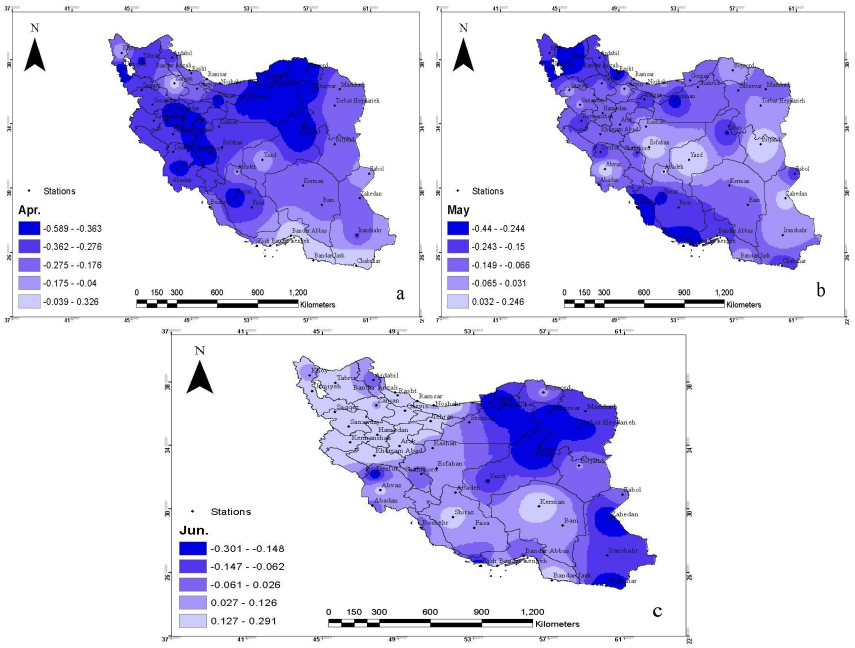

Fig. 3. Spatial distribution of the correlation between total monthly precipitation and mjo for (a) April, (b) may and (c) June

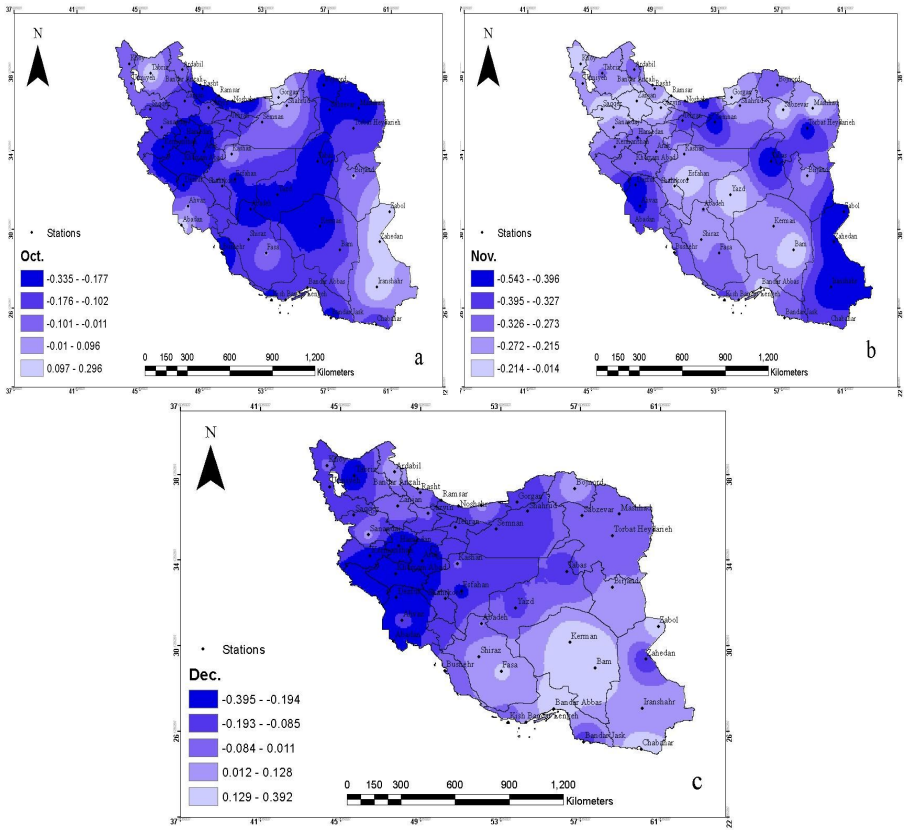

Fig. 4. Spatial distribution of the correlation between total monthly precipitation and mjo for (a) October, (b) November and (c) December

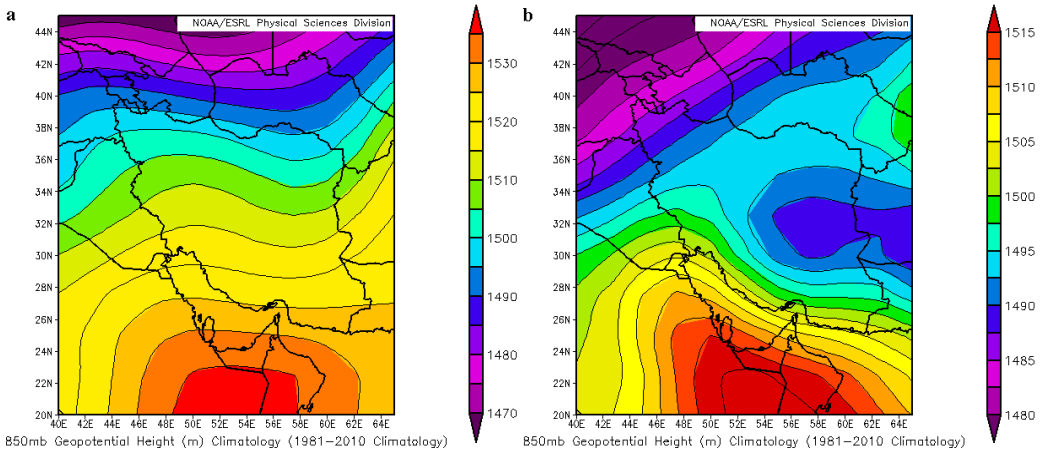

Fig. 5. 850mb geopotential height for (a) cold season and (b) warm season; shifting of the subtropical high pressure (STHP) to the north and south in the warm and cold seasons can be observed, respectively.

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RESEARCH ARTICLE

An Investigation of the Relationship between Ethical Climate and Ethical Behavior (Case study: Payame Noor University- Mazandaran Province)

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ABSTRACT

Organizations for doing their organization affairs, need to member of ethical and value guidance both organizational criteria and legal criteria. That these criteria help in their behavior and their actions. These criteria make harmony and unity in moving forward is feasible in suitable and optimal way in group or public. Usually, member of organizations accept a kind of value which is related to organizational life. Organizations have to create a climate with ethical and values. Understanding of acceptable kind of behavior is important factor in organization climate. The purpose of this paper is to view of relation between organization ethical climate and ethical behavior in managers. Statistical society of this research is managers in PayamNur University in Mazandaran province. A sample was selected with 51 respondents. So, with using of instrument of questioner data was collected. Finally, with using of correlation ways hypotheses were tested. The result of research has shown that there isn't any relationship among caring, rules and low climate with ethical behavior of managers and also, there are meaning full relationships between instrumental climate and independence climate with ethical behavior in managers.

Key words: ethical climate, ethical behavior, PayamNur University, instrumental climate, independence climate.

INTRODUCTION

Organizations for their doing organization affairs need to set of guidance from ethical guidance and value that these guidance help them in their behavior and action, these guidance can create a kind of harmony and unity way in moving forward to group and public way. Organizations have to create an climate with ethical and values. Understanding of acceptable kind of behavior is important factor in organization climate. Understanding of suitable behavior is part of organization climate, that it can be affect full in making decision procedures. The most comprehensible experimental document has been created by Orlitzky and et al (2003). They came to this conclusion that there are positive relations between social performance/organizational climate and organizational financial performance in industry and studying of text. Similar founding has been reported by Joyner and Payne (2002). In a recent studying, which has been done by Koh and Boo(2001), they found that tree criteria organization ethical principle with the name of (supporting of financial management for ethical behavior, ethical organization situation and relation between ethical behavior and job successes) they are related with job satisfaction. One of these current job climates in organizations is ethical climate. Many studies has shown that ethical climate in an organization effect as meaning full to ethical behavior to labor force.

Ethical climate in organization will be important resource for employee. It can help them what kind of actions in a job field are "right" or ethical.

Because of these matters, this study focuses on viewing relation between ethical climate in an organization and ethical behavior in managers. Rest of the paper has been organized with this style: First, review of the related literature and theoretical frame work has been studied. So, with presenting of theoretical research, it has been collected data with description of research method, and finally, with identifying of limitation in research, it has been come to conclusion about discussion and suggestion presentation for future research.

Ethical climate in organization

Ethical climate is kind and part of public climate in organization according Victor and Kulen (1987) view. Ethical climate in organization refers to how common conceptions from right ethical behavior and ethical matter manage.

Victor and Kulen (1988) present a frame work to measure for employee's conception from ethical tendencies with combining of theoretical structures from cognitive development, ethical theory and analyzing plane. They got their research through Kohlberg(1967) research. He has shown that individuals' recognition ability for ethical reasons is developing and ethical climate or upper level climate has been created by the group. If can be powerful adjuster in this process. Ethical climate is as framework for creation and strengthening of reasonable values, values and opinion (beliefs) that it may be related with organization view about "how should works must be done?".

It seems that if ethical climate in an organization be with common sense, rationalist, religion, exist of religion culture, social and other options like these, employee will follow suitable situation so, values in the organization will be power full and strong. Victor and Cullen have presented nine kinds of ethical climate according with ethical theory and situations .tree ethical theories: self centered, benevolence and principles according with tolerate to tree universals, local and individual centers. In fact (there are centers and these center has decision making power). Nine kinds and forms of ethical climate have been shaped. Every of nine kinds of climate have provided suitable and useful information which has effect full in organization behavior (Fig No.1).

The first theory which is to view and study here is “self center". Self centered is as notice to needs and preference to own property, organization or larger social system is defined that they are effect full under personal benefits, organization or developing of to be useful for organization. In this kind, persons may make decision according with

just their own benefits regardless of its effect to others. The second theory is "benevolence". In benevolence climate is to emphasis on from individual's tendency. It needs to persons who care and notice to the effect of performance and decisions to others .This climate provides include of kind of behavior which has most enjoy and the least suffer to more persons that include workgroup, organization and society. The Third one is as "Principles" has been recognized. Victor and Cullen has defined this climate that person has been effected by directed values, roles, organization approach, legal systems or professionals standards. In this kind, decision making is based on ethical principal. Decision making more is as judge than a consequence or result. Victor and Cullen have established five rules from ethical climate. They are including of tool liking, sympathy independency, roles, rules and codes. The first dimension is referred to a place which selfish is related to individual's places, local and universal that they are focused on employee and usefulness of organization. Tool climate supports from behavior with self centered approach in limit situation. In this kind, behaviors directed by individuals favorite. When the organization has sympathy ethical climate, it emphasizes on other facilities and the organization supports this kind of policies, procedures and strategy. In this kind of climate, not only Policy and Policies can develop climate, but also most of group member behave with this style. The third kind is called "Independency", It means that person choices himself and his or her idea. Making decision in this climate discourages to use personal idea deeply for decision, regardless of outside effect.

In the fourth dimension, rules and organization have been used; they decided them with especial attention. In this kind; roles and organization policies are based on Principles and they direct ethical decision .This dimension has some negative view, It has unclear roles and internal policies that it has conflict or against of rules and employee's standard. It has less attention to others and making decisions. The fifth kind of this is rules and professional codes; It is base on That Persons must be royalty to Principles, foreign rules, bible book and professional standards.

Theoretical Framework

Former and Past research has shown that ethical climate can have meaning full effect to ethical behavior in the organization. Martin an Culln (2006) have defined organization that ethical climate is a set of current climate in organization That it can reflex Policies , Policies and activities that they have ethical consequence from first research that has been done by Victor and Cullen in 1987 and 1988 , They referred identity of all kinds ethical climate . They are filed base on ethical theory research, developing of ethical and they focused on social cultural theory. They have defined five kinds of ethical climate is base on tree criteria (self centered, benevolence and legal tendency) and they defined tree analysis (individual, local and universal). Research in extra analysis have came to conclusion that There are Positive relation between some ethical climate and different climate from consequence and organization behaviors.

Deshpande (1996) made and established six kind of ethical climate, and he used it to view about activity of Manager's ethical in a large American organization. Martin and Cullen (2006) have done a research with kind of analysis about ethical climate to solve current un harmony and mismatch. They have got some founding about confirm of research and ethical theory climate in 1987 and1988.

They have shown that there are positive relation between Professional climate and rules with kind of consequence of organization they also came to this conclusion That There is weak relationship between more organization consequences and Independence climate. One of their suggestions is to organization decision maker must use their insights and conception which kind of ethical climate, development in their organization general situation will be facilitated. So under theories can be presented:

Main hypothesis

There is meaningful relationship between ethical climate in organization and ethical behavior of managers.

Secondary hypotheses

There is meaningful relationship between caring climates with ethical behavior of managers.
There is relationship between low climate with ethical behavior of managers.
There is relationship between rule climate and principle with ethical behavior of managers.
There is relationship between independence climate with ethical behavior of managers.
There is relationship between instrumental climate with ethical behavior of managers.

Methodology

This research about purpose point of view is a kind of applicable and about method for performance is kind of description – correlation .in this research is payamNur university in Mazandaran province , because of having a lot of branch numbers , researcher starts to sample them. Managers and deans of PayamNur university in Mazandaran province are sample and they are a few samples. So, researcher use census and 51 were distributed among managers. In this research for measuring of ethical climate, has been used and from 26 questions ethical climate from Victor and Cullen (1988) and for measuring ethical behavior from for and Joseph and Deshpande (2009) have been used. For determining validity, convergent validity was assessed for all constructs and indicators. Convergent validity was assessed by examining the factor loading for statistical significance that is less than 0.3 that have been shown in Table 1.

To determine reliability of the questionnaire, in this research, used Cronbach's alpha that its result has been shown in fig No2. Cronbach's alpha for constructs are so the questionnaire reliability is acceptable.

RESULTS

Static shows that 27.5 percent of answers are women and 72.5 percent are men. In other words, almost most of answers are men and collect data from men were better than women. With respect of extracted static it has been cleared that educated level of 2 percent of answers were under diploma and diploma, 33.3 were and Bachelor degree and 46.7 percent were masterdegree or upper. In other words, most of answers are educated. Among them, have high education like master degree or phd. With respect of extracted statistic, it can be said that most of employee's age are between 30 to 50 years old. And also, most of them have less than 10 years work experience.

With respect of results, it is seen that there is meaningful driven level for Pearson coefficient about the first hypothesis of research (relationship between ethical climate in organization and ethical behavior of managers) are more than 0.05 percent. As a result, with sure of 95 percent suppose or theory. H_0 has approved and H_1 has refused. And this is not authentic relation, and also ranges of correlation between two kinds of climate, caring and ethical behavior in employee is not authentic and there is no relation between them. The amount of meaning with test for the third hypothesis of research means relation between rule climate and ethical behavior were more than 5%. So, we can come to this conclusion that between two variables, there aren't any relations between rule climate and ethical behavior. Because amount of meaningful test is more than %5 percent. And also, with respect of result, it can be shown that the amount of driven level for test correlation coefficient about the fifth hypothesis of research is less than 0.05. As a result, with insure of 95 percent, suppose H_0 is refused and H_1 is approved. So, this relation is authentic. Also, correlation range between two variables, its mean independence climate and ethical behavior in employee are 0.381. That it shows or present a positive relation between two variables. With respect of the sixth hypothesis test result, it is shown that amount of driven level for correlation coefficient about the sixth hypothesis is less than 0.05. As a result, with insure of 95percent, suppose H_0 is refused and H_1 is approved. This relation is meaningful .also,

correlation range between these two variables means climate and ethical climate in employees are 0.343. It is shown that these two variables have negative relations.

DISCUSSION

The purpose of this research is to view and examine relation between ethical behavior in organization and ethical behavior of managers in payamnur university of Mazandaran province. With respect of result of test, it can be said that there isn't any relation between ethical climate in organization and ethical behavior in managers. Karimi and et al. (2010) have shown that organization climate (responsibility, conflict and standard) have positive relation with ethical climate. Rahimnia and Nikkhahfarkhani (2011) have shown between ethical climate insellers include of ethical, answering, employee's behavior and selling activities with organizational ID have Positive relation and they have negative relation with. Golparvar and Nadi (2011) have shown there are Positive relation among of ethical climate and job satisfaction and organizational commitment, and there is negative relation between ethical climate and .also, Deshpande (1996) and Victor and Cullen (1988) have shown ethical climate effect on ethical behavior in organization. Qadiri and et al. (2013) have shown that there are positive relations among of caring climate and job satisfaction and organizational commitment. Also, there are negative relation between friendship and job switching intention, also Deshpande and Joseph (2009) have shown that caring climate doesn't have any authentic and meaningful effect on nurses. The result has shown that with respect of amount of meaningful test from 0.05 is more, so, 5 percent error in zero statistical supposition is approved. It is said that there isn't any relation between rule climate and legal behavior. Qadiri and et al (2013) have shown that there are positive relation among of rule climate, satisfaction and job commitment and there is negative relation between legal climate and job switching intentions. Also, Koh and Boo (2001) have shown that there is positive relation between legal climate and job satisfaction. It can said that There is relation between independence climate and ethical behavior in managers and correlation coefficient between two variables are 0.387.Deshpand (2008) in his research has came to this conclusion That independence climate has positive and meaningful relation with legal behavior in nurses That its result, it The same as this research . Also Qadiri and etal (2013) have shown that there are positive relation among independence climate, satisfaction and job commitment and there is negative relation between independence climate and switching intention. also, It can be said that that there is relation between instrumental climate and legal behavior in managers and correlation coefficient of variables are 0.343. Deshpande and Joseph (2009) and also Deshpand (2008) in their research have shown that instrumental climate doesn't effect on ethical behavior in employee that this research is not the same as that research. The result of this research has shown that organization can show different patterns from ethical climate in different levels of tendency .legal climate is in highest level and independence climate is in lowest level from among of different legal climes in payamnur university. Also, This research has shown that some of the fifth pattern of legal climate maybe have relation with legal behavior. In any case, some of them don't have any relation with legal behavior .The result has shown that friendship climate, legal climate and rule climate don't have any relation with legal behavior. This subject shows that these legal climates among of managers in payamnur University in Mazandaran province doesn't have enough popularity. So, It must be used a kind of solving ways for decrease of these legal climates especially legal climate that it has highest level in this organization. Therefore, the result has shown that There is Positive and meaningful relation between instrumental climate and independence climate in this organization with ethical behavior in managers. Therefore, it is suggested that follow solving ways can be studied for reinforcement and developing of this ethical climates, which they include

Persons must not follow and peruse their benefits

- Persons must not think just themselves
- It must be emphasized on personal ethical
- For increasing of benefits in organization, It must be considered consequence of the results.
- Because of getting to his own benefit, must not ignore other things.

- lackness of to be standard and be interior of work, must not depend on organization .
Only responsibility of managers in this organization must not just control expanses.
Managers in these organizations must follow their beliefs and their ethicals.

About it be right or not right in affairs, They must decide themselves. It must be respected about their right or not right. It is expected by senior managers that respect employee's idea .of course it must not be conflict or against of the principle of organization and society. Employee must be encouraged by their expressing their idea.

With respect of current research in payamnur university in Mazandaran province has done, It cannot be generalized easily to all organization. It is suggested to researchers do this research like this. Other factors like individuals characteristic in employee and feature of organization can effect on ethical behavior that it is suggested that for future research will done.

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Study centers				
		Individual	local	universal
ethical climate	Self Centered	Personal benefits Tool liking	Benefit of organization Tool liking	Proficiency Sympathy
	Benevolence	Friendship Sympathy	Favorite team Sympathy	Social responsibility Sympathy
	Principle	Individual's ethical Independency	Rules and organization Methods. Roles	Rules and professional cods professional

Figure 1. Victor and cullen's dimension of ethical climate (1988)

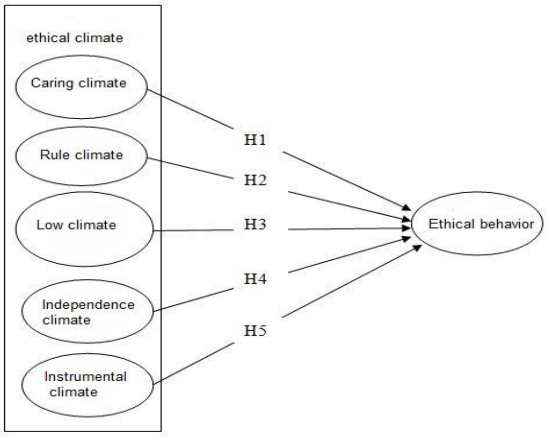

Figure 2. Conceptual model

Table 1. The result of factor loading for research questions

Items	Factor loading	Items	Factor loading
q1	0.472	q16	0.602
q2	0.425	q17	0.650
q3	0.668	q18	0.504
q4	0.754	q19	0.523
q5	0.914	q20	0.613
q6	0.464	q21	0.568
q7	0.332	q22	0.370
q8	0.466	q23	0.610
q9	0.585	q24	0.421
q10	0.396	q25	0.749
q11	0.514	q26	0.886
q12	0.947	q27	0.451
q13	0.629	q28	0.881
q14	0.482	q29	0.567
q15	0.498	q30	0.778

Table 2. Cronbach's alpha for constructs

Factors	Cronbach's alpha	Number of items
caring climate	0.829	7
low climate	0.843	4
rule climate	0.771	4
instrumental climate	0.624	7
independence climate	0.639	4
ethical behavior	0.719	4

Table 3. Correlation coefficient and meaningful of variables

Hypotheses	Variables	Correlation Coefficient	Sig	Result
1	Ethical climate and ethical behavior of managers	-	0.221	Refuse
2	caring climate and ethical behavior	-	0.937	Refuse
3	rule climate and ethical behavior	-	0.795	Refuse
4	Low climate and ethical behavior	-	0.971	Refuse
5	Independence climate and ethical behavior	0.381	0.006	Approve
6	instrumental climate and ethical behavior	-0.343	0.014	Approve

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RESEARCH ARTICLE

Structural Analysis of Kermani Vault and its Comparative Study with Different Kinds of Vault Performance in the Islamic Era

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ABSTRACT

History of vault returns to time which human was looking for shelter for life and security. In this time, human realized that he could build not so great shelter on stone basis by putting a flat and large stone on each other. The using peak of this art and applying vault and vault and domes returns to Sasanian era. In this era, the buildings were built by high veranda and low and high dome covering and by specific skill of architect of that time. Today, in new architecture, applying traditional architecture methods are still successive and different kinds of these methods are applied in building exterior facades, horseshoe port of doors and windows, entrance porch of mosques and Shabestan. Extensiveness of Iranian vaults make how these forces are operated by geometric form in terms of form and direct relationship and feel the independent point of view in defining different kinds of vaults that implies all cases geometrically. One of the neglected and seen vault in Iranian architecture is Kermani vault that is known as natural nunnery. This study aims to introduce vault kinds and compares it with Kermani vault (nunnery) that is a kind of track vault. Furthermore, this study examines properties of architecture operation and it root and Kermani vault samples and its structural behaviors. To do this purpose, in this study, descriptive-analytical-comparative procedure is applied and library and document method and field observation are applied for data collection that these data are analyzed qualitatively.

Key words: vault, Kermani, nunnery, arch, overlying

INTRODUCTION

Statement of the Problem

Extensiveness of Iranian vaults make how these forces are operated by geometric form in terms of form and direct relationship and feel the independent point of view in defining different kinds of vaults that implies all cases geometrically. One of the neglected and seen vault in Iranian architecture is Kermani vault that is known as natural nunnery. This vault is similar to track vault practically and structurally and is different just in bricklayer kind. Many properties of track vault are used in analyzing Kermani vault.

LITERATURE REVIEW

Significance of the Study

One of the important properties of houses and buildings in dry areas is arch and dome in their ceiling. Sagittarius and arch can be known as bending that is a part of certain geometric shape like a part of circle, hyperbolic or known curve (Pirnia, 1999:45). History of acres returns to a period that human was looking for shelter for life and security. Human realized that he could build not so great shelter by putting flat and high stones on each other and on stone basis. He could deploy the stone devices over time by discovering limestone and lime mortar. Then, in subsequent period, new improvement made in façade building by applying smaller stone devices stepwise (technical and professional training organization, 2008). Mostly, due to lack of wood in Iranian Plateau, to cover buildings ceiling, adobe and brick were applied and ceilings were built circularly half-a cylindrical shapes (vault) or hemisphere (dome). One of the preferable reasons of acre and dome vaults in these areas was high height of room from floor to vault below that resulted in natural vertical ventilation in rooms and replacement of cool weather in below levels of building and ascendant of warm weather toward higher levels. It is clear that this pressure resulted from ceiling overlying in Pakar roof area (acre starting point) was extremely high (Fathi, 2006). This case neutralized by various methods in building. One of the vault kinds that are placed in subcategory of track vaults, are known as Kermani vault or nunnery vault. Due to lack of literature reviews in this field, it is necessary to examine the structural properties and also Aesthetic of this vault comparing to other vaults and analyzed and compared obtained data by content qualitative method.

Procedure

Procedure of this study is a tool or a determinant of how a study proposition is confirmed or rejected, in other words, the procedure provides operation framework or searching objectives for achieving the study objectives regarding testing hypothesis or responding to research questions (Bazargan et al, 2006, p.22). The research procedure is descriptive-analytical and comparative kind and data collection method is library and field method. In this method, researcher used the most important device means note taking and he wrote important and necessary material with reference to identified sources by mentioning exact properties of applied sources and next, he analyzed obtained data by using observation and searching devices in environment and as a result by content qualitative method.

Research Questions

To do this study, at first, the relative questions were raised to extend this study based on these research questions and achieved considerable objectives. These research questions are as follows:

Main question

What differences are there between vault kind and other vaults?

Subsidiary questions

What are the property of Kermani vault by nyarsh and static views?
How Kermani vault is developed by executive technology?
What are properties of Kermani vault Aesthetics?

Kermani vault (nunnery) and its sample

When the architecture of different areas of world in different centuries are taken into consideration, the architecture is found scarcely so variety and astonishment that are seen special Iranian architecture in traditional architecture and authorization and creation of areas coverage are revealed. Iranian architect considered roof as if he does not any concern and he does not consider below levels and pays attention to marquee. One of the architectural masterpieces of Iran was the design of ceiling overlay with advanced structures in certain time and place, although geometry of traditional ceiling is usually a vault and dome kind. But, so viewer eye is starred that far way him from thinking of applied skill and its executive issues (Fazeli, Gharaei Najaf Abadi and Esmaieli, 2014). Iran is not deprived from forest resources and benefits from its monument building of architectural system. First, its skeleton was from Wooden scaffolding like Parseh palace and common architecture in forest areas and second, it was established based on vault application that almost all monument were shaped either by Islamic magnificent or available buildings in most towns and villages of Iran plateau.

But, here, we should mention Sassanian dome. The vaults of this era are in cradle, dome and conical shape that the make easy the transition from the quadrilateral plan of the base and reach to rounded plan of dome. Shoazi “from past eras up to now, Iranians were not familiar with cradle vault and domes that was stable on trunks which seems that skullcap dome and vault is appropriate for ceiling of square Shabestan. Natural vault of these monument is known as natural vault of nunnery method that four walls and an area with gradual arch continues and roofs this area that wooden scaffolding is not needed and this valuable property is a clear innovation that Iranian displayed to arrange dome building with below ceiling.

Niasar temple as most training of Sassanian monuments, is illuminating and also was applied at beginning of Sassanian era for dome building, in Iranian monument building, single vault or additional vaults without scaffolding were applied. This indicated that to what extent Sasanian had skills and explained their abilities in establishing European nunnery method. This temple is placed on Kashan-Delijan path that is near to a spring that reed grows nearby. So, they established it by using materials such as stone, plaster and reed and by well architecture that probably architect had been living in Kashan. Creator of this temple did not access to wood and when he built below levels, he knew that next himself and other people help him that can move on monument easily and access to materials around dome that should be built in future. Due to this issue, he created entrance reed with more than 2 width around dome and increased wall thickness that was highly intelligent. This monument is like cube-shaped pile from outside that four opening of wide port are placed on upper level and distance between base and dome and is cube-shaped; but from inside, like domes of nunnery style, they are placed directly on walls of square Shabestan and access to gradual curve from quadrilateral plan of the base in dome rounded-shape (Gedar, 2008).

In following image that shows the traditional house, is structural and weight system that means load transmission of coatings make by pier and substratum, and applied coverings in this monument was an arch-shaped kind and applied different rooms: track room, Kermani room and Kalambo room…

Performance method of Kermani Vault

Behavioral Kermani vault is similar to track vault and the only difference of these two kinds is in bricklaying kind. So track vault is applied for explaining and analyzing Kermani vault properties and advantages in this study. This vault is made by circular movement of a line around Parallel axial with Cylinder. Page which is parallel with circular axial and cut cylinder, make track vault. In other words, track vault is made by transmission movement of a curve in one direction (figure 1).

For building track vault, we should make two parallel and vertical walls with floor and then install plaster templates at its beginning. If two wall templates are drawn hypothetically through Pakar, almost half-cylindrical shape are made that it is called track vault (Vali Beig, Mehdi Zadeh Seraj and Tehrani, 2012:40). Using this kind of vault is consistent with its below areas and commonly Rectangular spaces like corridors, porch and …or in other words, spaces are space-oriented. Executively, track vault are applied by fairy and roman method and by a leaf and two-leaf plaster.

Many samples of this kind of vault were made in Pre-Islamic and post-Islamic architecture. in Choghazanbil templates in 1250 BC, in Ashkani and Sasanian architecture, monuments are covered like Kasra vault with this kind of vault.

In Tarikhaneh template of Damghan, Jameh mosque of Nain, Jameh mosque of Isfahan, Jameh mosque of Ardestan, Jameh mosque of Natanz, vast areas are covered by this kind of vault. They usually got assistance from track vault in covering large porches in Timurid period (Memarian, 1988).

For implementation of full and fallen track arch, we need to rely on pier that geometric shape of Kermani arch are drawn by rope circulation and by using mud and corner between pier and spray is implemented so that it is started and finished by fallen operation [1].

Coverings in Kermani Arch

Kermani arch have structural behavior almost like trach arch that excretes the force through vault arch but difference is that the smaller opening turned into inside but a bricklayer is not eight and stuck. However, it bear negligible percentage of force and consequently, it bears most loads of two stretched piers that makes focus in driving forces in two wings of arch.

Performance method

Arches are bricklaying in beat method and roman arch are done in its wall earning, order arch are included between vaults until Pakar, for implementing arch, first, three beat bond are implemented as doublet including blade bond, beat bond are bricklaying respectively. Small opening of arch is implemented respectively, both side are bricklaying for closing arch corners to two corners reached together and with Garz that is usually brick pieces, arch is closed. For leveling ceiling, brick and soil trash are filled between arches and as a result thatch coating for insulating.

Forces analysis

It is difficult to analyze and evaluate structural forces and feedback of forces reactions in Iranian traditional structures due to inconsistency of applied material behavior against force. Regarding this issue, we can say that forces cannot be modelled traditional structures **(**Memarian, 1988).

Static and Niarsh in Kermani Arches

Kermani vault is made by combining and sticking single arches along an axis that there is no difference between static operation of arches and vault and because it covers spatial vault, arch operation should be considered along spatial axis. For calculating static conditions in Kermani vault, it is sufficient to analyze unit length in structure and as a result, obtaining forces or R fall inside 1/3 basis thickness or in inertia core or if we cut each part of vault thickness and this force is in range. As for driving in an arch, we need an implementation and also it is necessary to employ different methods, for vault, method like applying successive trailer can be used (Memarian, 1988).

For controlling forces in vault, various methods are used as following:
1-using thick walls beside arch
2-using minaret around arch
3-using raking
4-using wood as horizontal pieces of wood
5-using skein around arch
6-using bricklaying combinations (beat and roman)
7- Filtering
8-performing row arch

Materials layout and Aesthetic in Kermani Vault

Three methods of filling (multiplicative, plectrum), blade (leaf) and Roman (Hara, a vein) are usually used for material layout in vaults that filling and roman method are used more in Kermani vaults (figure 7).

By observing above figure, what it can be starred in first look, the clear weakness of porcelain vein method in common arch vaults. Therefore, whatever bricks are closer to place of arch crown, due to reduction of gradient, masters have to consider more gibbosity in successive veins so that in final veins, very short part of bricks length are in contact with and support each other and or, as it was shown in figure, the two final veins are not in contact with each other no longer. Due to this issue that porcelain vein method are only seen in dome of vein, because, in this case, basically, layout method of material is that dome figure is dictated to it. Nevertheless, this vaulting method is the resulting driving amount that is lower than corrugation method, but weakness of this layout should not be forgotten as a great flaw against resulting cut of side forces. On the other hand, each of shown in three layout are also have advantages and disadvantages that they are pointed in table of next page.

However, monotheism is the first principles of Islamic beliefs and reflection of this belief in Islamic art is resulted that element of Islamic. "Monotheism" as aesthetics of Islamic art is made based on diversity in unity and unity in diversity that implies monotheism and circular shape as symbol of universe that is applied in vault and god is the center of it and axial decoration. Circular shape is that it guides addressee look from scattering to a point that is its center. Aesthetics rules of religious art are made on their beliefs basis (Fahimi Far, 2009). When vault as traditional word is applied as architecture notion and points to literature notion on movement from inside of certain space that is done in certain time?. Gate of a city and chapter of a book are called portal, whether is in the beginning of travel or its ending. This indeterminate meaningful symbolic transmission includes portal of mountain crossing without

considering scale and declares embossed role of entrance to a place (distinct location), gates of cities entrance were related to body pores and winter and summer changes relate to sky portal (Ardalan, 2011).

CONCLUSION

One of the most single Iranian vaults is Kermani vault that is the continuous barrel vaults in through certain path. This kind of vault has many similarities with track vaults and also has differences with bricklaying in few cases. Kermani vault is most appropriate covering in monuments that are continued in both sides of two walls and like water storages, porches, platforms and rectangular shapes that are willing to have steady ceiling. Kermani vault is performed mainly in beat kind of vault. Below vault can be covered with different decoration like Goharshad mosque of Mashhad that is tilled. Below vaults is sometimes operated or mineralized. Kermani vault is made by combining and sticking single arches along an axis, so it does not differ in static operation with static operation of arch. Applying this kind of arch is usually appropriate for below spaces and usually for rectangular spaces like aisles, porches and etc. valuable samples of kermani vault monuments had been built in pre-Islamic and post-Islamic. The most ancient samples can be seen in Chogharzanbil in discovering Hafttape in Khuseztan area about 1250 BC. Due to simplest operation of Kermani vault comparing to other vaults, this is used in local architecture especially dessert home that its large samples can be found in halls of Yazd home. Performance method of this vault in Iran can be different from western kind. Finally, it should be mentioned that this kind of vault was applied for spaces with low portal by blade operation method. So, it is not appropriate for very large portal and it must have square or rectangular plan.

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Figure 1: Samples of interior and exterior images of Kermani vault

Figure 2: Applied vaults in a traditional house

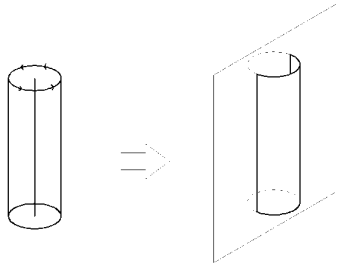


Figure 3: Circular movement of a line around parallel axial

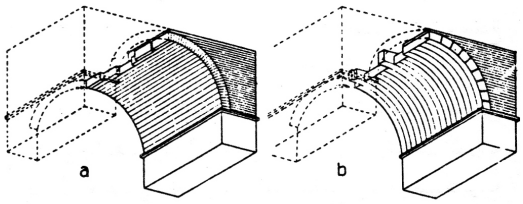


Figure 4: Performance method of Kermani vault by fairy and roman

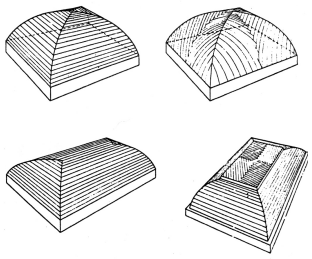


Figure 5: Different shapes of Kermani Vault

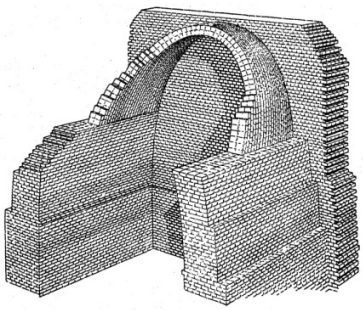


Figure 6: Need for Fulcrum on pier for performing Kermani arch

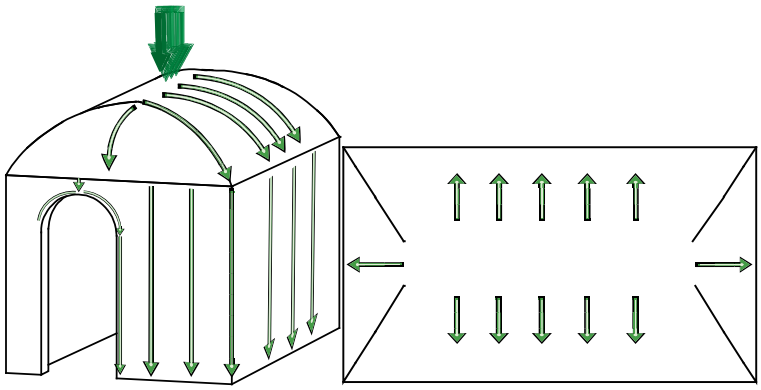


Figure 7: Analysis of forces movements in Kerman arch

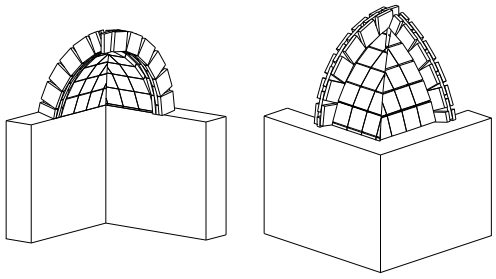


Figure 8: Unbalanced division of forces in Kermani arch

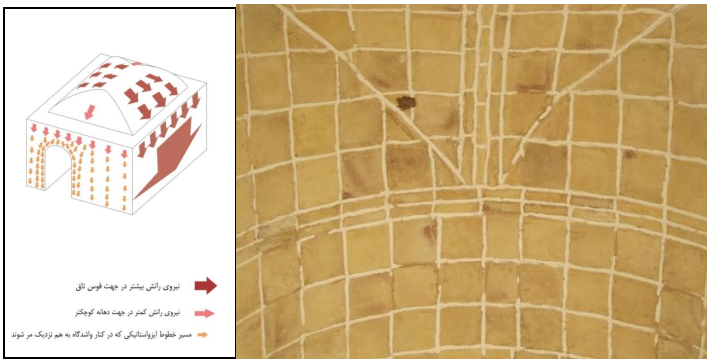


Figure 9: Analysis of forces in Kermani arch

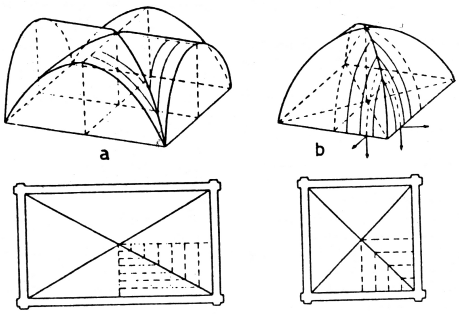


Figure 10: Applying successive trailer in Kermani Vault

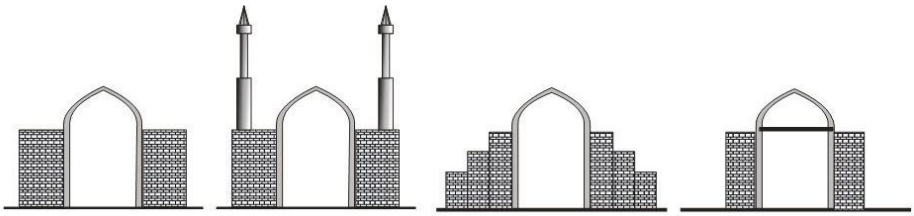


Figure 11: Samples of control methods of force in vaults

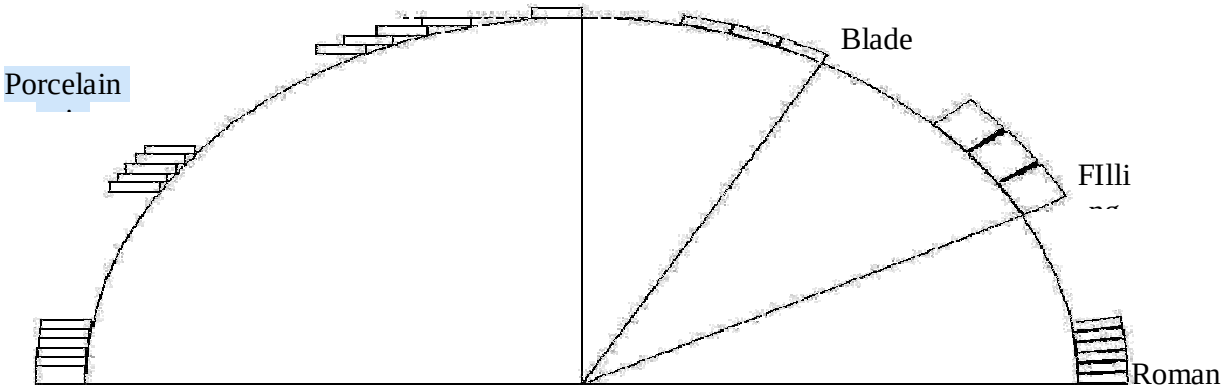


Figure 12: Simultaneous comparison of different layout

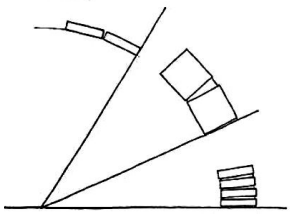
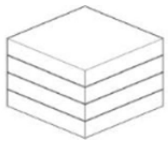


Figure 13: three kinds of bricklaying (from above) leaf vaults, filling and roman (Fakhar Tehrani, 1992)

Table 1: Covering performance method (Jazbi, 1987) (Fakhar Tehrani and Tokalou, 2003)

	Performance kind		Explanation	Bricklaying kind[3]
Covering performance method	Used in Kermani Vault	Roman vault	Stone vessels and bricks are continued from both sides and are locked in head of covering, like it is included in substratum, and in this performance method, we should use this formatting in arch below	
			Contrary to roman kind that is parallel with bricklaying of walls and substratum, vessels of arch brick is vertical on	

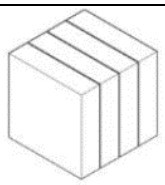
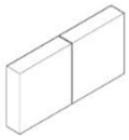
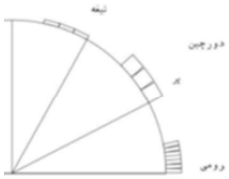
		Beat arch	brick vessel of walls and it is necessary to embed the first vessel of arch at the beginning so that is the field for other vessels that can add next vessels.	
	Blade arch		Contrary to previous two kinds that are placed on each other through width, in this performance method, brick are joined by blade-shape means its width	
	Synthetic arch		When the performance method of arches are composed of previous arches	Par Bricklaying developed vertically on arch and roman and blade bricklaying within the arch, so that performance method of bricklaying with its development method make 34 angle
	Arch		In used dome coverings, the method is that each vessel is placed on vessel below in horizontal level of dome circularly, since interior and exterior curve to follow arch of dome	

Table 2: overview comparison of properties, advantages and disadvantages of three kinds of layout (Fakhar Tehrani and Kusheshgaran, 2003)

Used in Kermani vault		**corrugation**
roman	**filling**	
Before reaching to two leaf vault, heavy format (cans format)is needed that is resulted to long, detailed and difficult of roman vault building	It needs light format only as vault shape pattern that it is takes into account as great rate against roman layout	It is performed without format and its curve are controlled by observing
It has the great loading ability, without it is captured by side form modification	It is loadable, furthermore, side form is changed (suffered)	Not only, it does not have any loading ability, but, belt strips are used to consolidate part of it and Plaster slurry is applied for increasing thickness
There is more consistency in weed mortar	There is less consistency in weed mortar	-------
Its jamb is rooted in vault and octagon	Its jamb is not rooted in vault	This layout is not applied in vault building
Due to placing brick in smaller lateral in arch page, it adopt easily curve form.	Due to placing brick in larger lateral in arch page, this curve turn into set of broken lines	The forming problem are twice in this layout, especially this coverings which have curve around two axis and this issue is resolved by increasing weed mortar and using brick pieces.
The vault is vertical on pier and is applied in vertical pages	It is performed in non-vertical pages on pier and it makes various forms such as pour boy, cross	It is only performed in vertical side of pier
Considering this layout, this cut forces took short and direct path through mortar and it damages the vault.	Contrary to roman layout, octagon existence in successive veins of this layout results in long path against cut force and depreciates destructive forces.	This resulting vault of this layout cannot bear these cut forces and these plaster slurry and brick pieces improve its level largely.

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RESEARCH ARTICLE

A New Approach to Optimal Location of Unified Power Flow Controller in Power System

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ABSTRACT

This paper presents an algorithm known as Cuckoo Optimization Algorithm (COA) to find the optimal number and locations of unified power flow controller (UPFC) in power systems. UPFCs are of special importance, because they have capability of simultaneously controlling active and reactive power of the lines and voltage of buses and they also have a high flexibility in the grid. The separate model of the UPFC is used in this paper to maximize loading capacity of transmission lines. Also, capacity limits of transmission lines and given voltage level are considered as constraints. Optimal locating of UPFCs by use of the new algorithm leads to a smooth voltage profile and increased capacity and stability of the transmission lines. At last, simulation and analysis of the obtained results are addressed. For this purpose, a standard 14-bus IEEE power system has been tested here and effects of accurate and optimal locating of UPFC are observed. Obtained results will show that with consideration of optimal location and appropriate parameters of UPFC by use of the mentioned method in this paper, steady state operation of the system efficiently improves.

Key words: Cuckoo Optimization Algorithm (COA), UPFC, Power Flow, Optimal Location

INTRODUCTION

In the recent years, steady state operation and appropriate planning and utilization of power systems have become as one the main challenges. The more power systems are extended and complicated and their loading is heavier, the more their operation is subjected to instabilities such as excessive thermal overloading, voltage collapse, frequency oscillations etc. Maintaining a reliable voltage level in an allowable limit is essential for reliable operation of power systems. So, controllability of power systems with the aim of fully use of available capacity will be essential in the system. Development of manufacturing technology of new power semiconductors followed by extension of FACTs devices have provided a suitable situation to control power and increase loading of present transmission networks. UPFC is a member of FACTs devices' family which is able to simultaneously or separately control both active and reactive powers. Also, they will have ability to control power flow. Some papers with various aims and methods have been published about optimal locating of UPFC. In, Lagrange coefficient method has been applied for optimal locating of UPFC. In, Genetic Algorithm (GA) has been used for optimizing three parameters of FACTs devices including TCSC, TCPST, TCVR and SVC. These three parameters include installation location of FACTs devices, type and their nominal ratings. But, in the above mentioned papers there has not been done any studies about UPFCs.

The main aim of this paper is proposing an appropriate method to find and choose optimal location of UPFCs in power systems in a way that loading capacity of transmission lines are maximized and all constraints of system including voltage level limits and capacity of transmission lines are simultaneously considered and satisfied. Optimal locating of some FACTs devices is turned into an optimization problem which is solved by Cuckoo Optimization Algorithm (COA) in this paper. COA has a high ability in finding the optimum solution. In the follow, basic results of the mentioned method obtained from a standard 14-buses IEEE system will be shown and effect of the method will be specified.

Mathematical Model of UPFC

The UPFC may be seen to consist of two voltage source converters sharing a common capacitor on their DC side and a unified control system. A simplified schematic representation together with its equivalent circuit of the UPFC is given in Fig. 1. The UPFC allows simultaneous control of the active and reactive power flow, and voltage magnitude at the UPFC terminals. Alternatively, the controller may be set to control one or more of these parameters in any combination or to control none of them

The active power demanded by the series converter is drawn by the shunt converter from the AC network and supplied to bus m through the DC link. The output voltage of the series converter is added to the nodal voltage, say bus k, to boost the nodal voltage at bus m. The voltage magnitude of the output voltage V_{CR} provides voltage regulation, and the phase angle δ_{CR} determines the mode of power flow control.

Implemented Model for optimizing location of the UPFC

Two types of UPFC model is represented in the papers. One is a coupled model and the other is decoupled model. In the first type a UPFC is modeled with a voltage source series with impedance in the transmission line. In the second type a UPFC is model with two separated buses. The first type is more difficult compared with the second one and the modification of the Jacobean matrix of the system should be applied if it is used. On the other hand, the decoupled model can be easily used in conventional power flow methods without changing the Jacobean matrix of the system. In this paper the decoupled model, as shown in Fig. 2, is used for the power flow study.

If the UPFC is assumed to be lossless, the real power flow P_{ij} that flows from bus i to bus j can be written as:

$$P_{ij} = P_{U1} \quad (1)$$

Although a UPFC can control the power flow, but cannot generate the real power. So equation (2) should be considered in the model.

$$P_{U1} + P_{U2} = 0 \quad (2)$$

The values of Q_{U1}, Q_{U2} can be set to an arbitrary value within the capacity of the UPFC to maintain the bus voltage. In the same way if multiple UPFCs are installed in the power system, the control variables for the k_{th} installed UPFC are shown as follows:

$$UPFC_{k-th} = \left[P_{K1}^{U}, Q_{K1}^{U}, P_{K2}^{U}, Q_{K2}^{U} \right] \quad (3)$$

So that:

$$P_{K1} + P_{K2} = 0 \quad (4)$$

An overview of Cuckoo Search Algorithm

Cuckoo Optimization algorithm (COA) flowchart is shown in the following figure. Like other evolutionary algorithms, the COA begins with an initial population which consists of Cuckoos. This population of cuckoos has eggs which lay them into the host birds' nests. Some of these eggs, which are more similar to the host bird's eggs, have more chance to grow and become the young cuckoos. Other eggs are recognized and disappeared by the host bird. The rate of grown nest eggs shows the suitability of the nests in that area. The more eggs in the environment are able to be survived and saved, the more profit (tendency) is assigned to that area. Therefore, a situation, in which the greatest numbers of eggs are saved, is the parameter which the COA intends to optimize it. (Fig. 3)

Cuckoos search for the best place for maximizing the survival of their own eggs. The communities and groups are created after the cuckoos' chicks get out from the eggs and change into the adult cuckoos. Each group has its own habitat. The best habitat for all groups will be the cuckoos' next destination in other groups. All groups migrate to the best existing region. Each group resides in an area close to the current position. Several egg laying radii will be calculated and created by considering the number of egg, which each cuckoo will lay, in addition to the distance of cuckoos from the current optimal area for habitat.

Then, the cuckoos start laying the eggs in the nests within their own egg laying radius. This process continues until reaching the best place for laying the egg (The region with the highest income). This optimal location is where the greatest numbers of cuckoos are gathered.

Building the cuckoos' primary habitat (initial population of candidate solutions):

For solving an optimal issue, it is necessary to form the variables of issue in the array form. These arrays are determined with the names "chromosome" and "particle position" in the GA and PSO, but this array is called the "habitat" in Cuckoo Optimization Algorithm (COA).

In an optimization problem, the next N_{var} of a habitat will be a $1xN_{var}$ array which shows the current position of cuckoos. This array is defined as follows:

Habitat = [x1, x2, ..., x_{Nvar}]

The suitability amount (or benefit rate) in current habitat is calculated by evaluating the profit function (f_p) in habitat. Thus:

Profit = f_p (habitat) = f_p (x1, x2,..., x_{Nvar})

As it can be seen, the COA is an algorithm which maximizes the profit function. For applying the COA in minimization problems, we should just multiply a negative sign by the cost function.

A habitat matrix with the size N_{pop}*N_{var} is built in order o start an optimization algorithm. A random numbers of eggs are assigned for each of these habitats. In the nature, each cuckoo lays 5 to 20 eggs. These numbers are used as the higher and lower limit for assignment of egg to each cuckoo in different iterations. Each cuckoo's another habit is that they are lay their eggs in a specific domain.

Hereinafter, the maximum egg-laying domain is called the Egg Laying Radius (ELR).

In an optimization problem, the higher limit of variable is shown by var_{hi} and the lowest limit is shown by var_{low}. Each cuckoo has ELR which is proportional to the total number of eggs, number of current eggs as well as the higher and lower limits of issue variables.

Therefore, ELR Is defined as follows:

$$ELR = \alpha \times \frac{Number\ of\ current\ cuckoo's\ eggs}{Total\ number\ of\ eggs} \times (var_{hi} - var_{low}) \quad (5)$$

Alpha is the variable by which we adjust the maximum value of ELR.

Cuckoos' method for laying the eggs:

Each cuckoo lays randomly the eggs in the host birds' nests which are in the ELR. (Fig 4)

When all cuckoos lay their eggs, some of the eggs, which are less similar to the host bird's eggs, are identified and thrown out of the nest. Thus, after each egg-laying, p% of all eggs (usually 10%), which their profit function is lower, are eliminated. Remaining chicks feed and grow in the host nests.

Another interesting point about the cuckoo chicks is that only an egg can grow in each nest because when the cuckoo chicks get out of the eggs, they throw out the host bird's eggs from the nests and if the host chicks get out of the eggs sooner, the cuckoo chick eats the largest amount of food which the host bird brings (the chick pushes the others over with its 3 times larger body) and after a few days the host bird's chicks will die of starvation and only the cuckoo's chick survives.

Cuckoos' Immigration

When the cuckoos' chicks are grown up and become young, they live in their own groups and environments, but when the time of laying the eggs becomes close, they will migrate to better habitats where the chance of eggs' survival is higher. After forming the cuckoo groups in different geographical areas (searching space of issue) the group with the best position is selected for other cuckoos as the target location for migration.

When the mature cuckoos live in all parts of environment, it is difficult to determine which cuckoo belongs to which group. For solving this problem, the cuckoos' grouping is performed by classification method K-means (a k from 3 to 5 is usually sufficient).

When the cuckoos' groups are made, the average profit of group is calculated in order to obtain the relative optimality of group habitat. Then, the group with the highest average profit (optimality) is selected as the target group and other groups migrate to it.

During the migration to the target point, the cuckoos do not pass all the way to the target point. They just pass a part of path in which they also have the deviation. Such this movement is clearly shown in the following figure. (Fig. 5)

As shown in the above figure, each cuckoo only passes λ% of the whole path towards the current ideal goal and it has also a deviation of ϕ Radian. These two parameters help the cuckoo to seek further environment. λ is a random number from 0 and 1, and ϕ is a number from $-\pi/6$ to $\pi/6$. When all cuckoos migrated to the target location and the new residential areas of each one is determined, each cuckoo owns a large number of eggs. Given the number of each cuckoo's egg, an ELR is determined for it and then the egg-laying starts.

Eliminating the cuckoos in inappropriate areas

Given this fact that there is always a balance for the population of birds in the nature, the number like N_{max} controls and limits the maximum number of cuckoos who can live in an environment. This balance is established due to the dietary restrictions, hunted by the hunters and the inability to find the suitable nests for eggs.

Convergence of the algorithm

After a few iterations, the whole cuckoo population reaches an optimal point with the maximal similarity of eggs to the host birds' eggs as well as the location of largest amount of food sources. This place will have the highest overall profit and the lowest number of eggs will be destroyed there. The convergence more than 95% for all cuckoos towards a point causes that the Cuckoo Optimization Algorithm (COA) to be ended.

Optimization Strategy

The aim of the optimization is to perform a best utilization of the existing transmission lines. In this respect, UPFC device is located in order to maximize the system loadability while observing thermal and voltage constraints. In other words, it was tried to increase the power transmitted by power system as much as possible to the costumers with holding power system in security state in terms of branch loading and voltage levels. The objective function is made in order to penalize configurations of the UPFC which lead to overload transmissions lines and over or under voltage at busses. The objective function is defined as the sum of two terms. The first one is related to the branch loading which penalizes overloads in lines. This term is called LF and is computed for all lines of the power system, if branch loading is less than 100% its value is equal to 1; otherwise, it decreases exponentially with respect to the

overload. To accelerate the convergence, product of values for all objective functions is calculated. The second part of the objective function is for voltage levels that are named BF. This function is calculated for all buses of power system. For voltage levels between 0.95 and 1.05, values of the objective functions are equal to 1. Outside this range, value decreases exponentially with the voltage deviations. Therefore, for a configuration of UPFCs, objective function is given as:

$$LF = \begin{cases} 1 & , \ BL < 100 \\ \exp[0.0461(100 - BL)] & , \ BL \geq 100 \end{cases} \quad (6)$$

$$BF = \begin{cases} 1 & , \ 0 \leq V_L \leq 100 \\ \exp[-23.0259|1-V_L|-0.05] & , \ 1.05 \leq V_L \leq 1.25 \\ & or \ 0.75 \leq V_L \leq 0.95 \end{cases} \quad (7)$$

$$Objective\ Function \quad OF = \prod_{i=line} LF_i + \prod_{j=buses} BF_i \quad (8)$$

The Cost Function for the COA is computed by minimizing the inverse of the Objective Function, defined as follows:

$$Cost\ \ Function = \frac{1}{OF} = \frac{1}{\prod_{i=line} LF_i + \prod_{j=buses} BF_i} \quad (9)$$

Where, LF is the line flow index and BL is the Branch Loading (Percentage of the line flow with respect to the line capacity rate). BF is bus voltage index and V_L is per unit value of the bus voltages.

Case Study

The load increasing studies on the real power system are done for different aims in planning and operation process of the system. For long-term studies of the power system, it is necessary to consider both active and reactive load increasing. The standard IEEE 14-bus test system is shown in Fig. 6 to demonstrate the effectiveness and validity of the proposed method. The numerical data and parameters are taken from [7]. In this way, new values of voltages and active and reactive powers of the net and also the value of the objective function are obtained. By iterating this process and a comparison between fitness values, the best chromosome meaning best found solution is introduced.

Suppose that the given number of UPFCs is set to 2. In case of using just one UPFC in the system, the proposed algorithm yields a seven-segmented result as the optimal solution. In Table 1 the numbers one and four express the bus number which one UPFC is located between them. The second and third numbers show the values of injective active and reactive powers, respectively into the bus 9 and the fifth and sixth numbers, respectively show the injective active and reactive powers into the bus 4. Seventh number also gives the fitness value defined in the Eq. (9) for the UPFC. In case of using two UPFC in the power system simultaneously, the proposed algorithm represents the optimum solution. The first UPFC is set between the buses number 3 and 4 and the second UPFC is set between the buses number 5 and 6. The simulation result is shown in Table 2. The numerical results before and after UPFC placement in the network is shown in Tables III-V. It is observed form the simulation results that the voltages of buses of the network are in authorized range and the profile of the voltage is satisfactorily flat.

CONCLUSION

In this paper, effect of optimal locating of UPFC on an unstable power system (due to over loading), has been studied and a mathematical model has been proposed to simultaneously optimize location and parameters of UPFC. Also, Cuckoo optimization algorithm was used to solve the nonlinear problem. The algorithm procedure was also completely studied in this paper. Simulation of a 14-buses IEEE power system verified the effectiveness and accuracy of the proposed algorithm. Simulation results suggest using more of these FACTs devices and tools in designing power systems. Also, the obtained results show that by optimal locating of FACTs devices with these methods and considering load growth curves, it is possible to do an optimal and suitable design in future for power systems.

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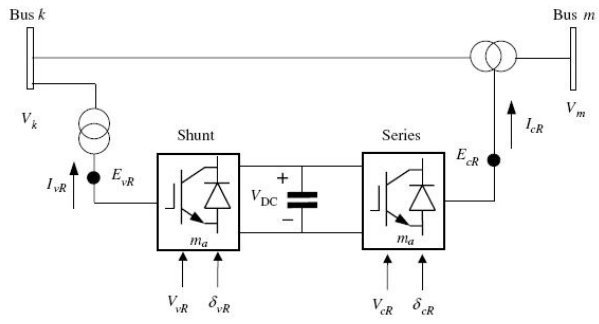

(a)

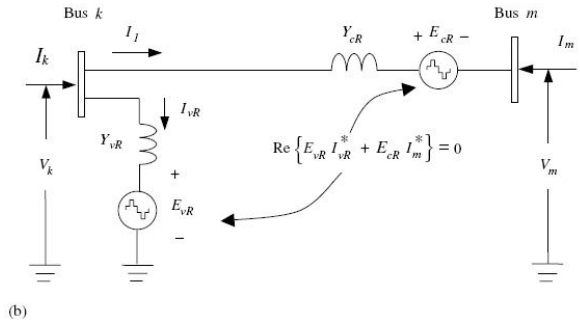

Figure 1. Block diagram of the UPFC system: (a) Two back-to-back voltage source converters (b) Equivalent circuit of a UPFC.

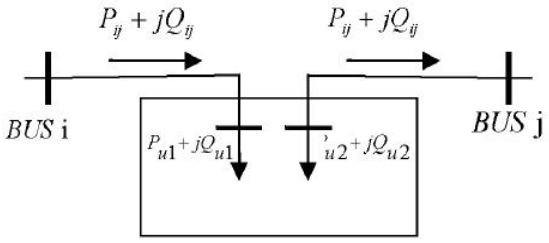

Figure 2. The decoupled model of UPFC

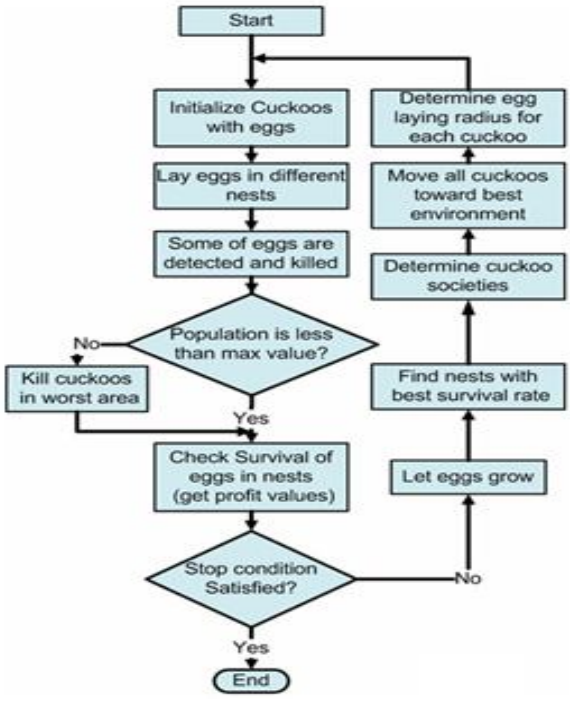

Figure 3: Diagram of Cuckoo Optimization Algorithm

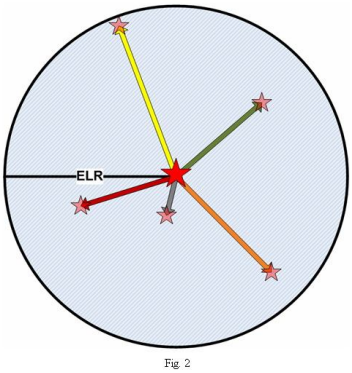

Figure 4: Showing the ELR

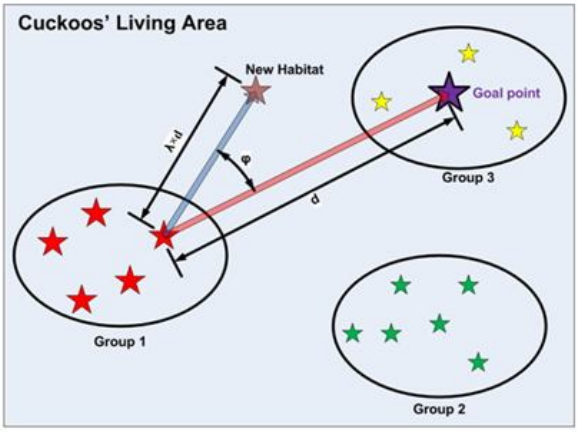

Figure 5: Cuckoos' Living Area

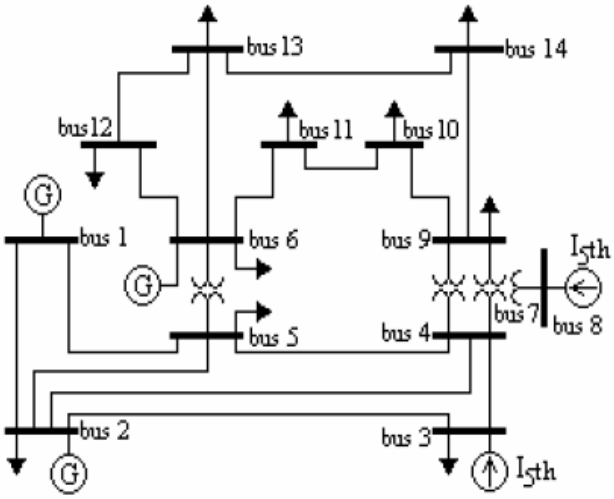

Figure 6. A standard IEEE 14 bus system

Table 1. The best results for 1 UPFC

1	2	3	4	5	6	7
Bus Number	P_i	Q_i	**Bus Number**	P_j	Q_j	**Fitness**
9	**-38.89**	**-25.02**	**4**	**-199.63**	**-148.97**	**0.0571**

Table II. The best results for 2 UPFC

1	2	3	4	5	6	7	8	9	10	11	12	13
Bus Number	P_i	Q_i	**Bus Number**	P_j	Q_j	**Bus Number**	P_i	Q_i	**Bus Number**	P_j	Q_j	**Fitness**
3	**-127**	**86**	**4**	**-211**	**-135.65**	**5**	**-9.42**	**-3.59**	**6**	**-14.83**	**80.34**	**0.1186**

Table III. The result of buses voltages of power flow

Bus Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Voltage without UPFC	**1.05**	**1.05**	**1.036**	**0.985**	**1.000**	**1.050**	**0.955**	**1.050**	**0.901**	**0.888**	**0.957**	**0.947**	**0.953**	**0.859**
Voltage with one UPFC	**1.050**	**1.050**	**1.024**	**1.011**	**1.020**	**1.043**	**0.963**	**1.049**	**1.051**	**0.956**	**1.011**	**1.018**	**1.034**	**0.965**
Voltage with two UPFC	**1.050**	**1.050**	**1.015**	**1.009**	**1.018**	**1.063**	**1.008**	**1.069**	**1.067**	**1.009**	**1.001**	**0.998**	**1.001**	**0.999**

Table IV. The result of active power flow

Line Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Power Flow without UPFC	**0.907**	**0.123**	**0.035**	**0.288**	**0.170**	**0.115**	**0.014**	**0.086**	**-0.12**	**0.420**	**-3.71**	**-1.29**	**-0.02**	**1.621**	**1.494**	**1.278**	**0.093**	**0.739**	**0.420**	**0.002**
Power Flow with one UPFC	**0.501**	**0.164**	**0.049**	**0.381**	**0.269**	**0.171**	**-0.033**	**0.171**	**-0.162**	**0.313**	**-0.84**	**-0.98**	**0.291**	**0.752**	**1.024**	**1.073**	**0.192**	**0.902**	**0.634**	**0.004**

Power Flow with two UPFC	**0.514**	**0.478**	**0.100**	**0.52**	**0.203**	**0.188**	**-0.019**	**0.199**	**-0.71**	**0.407**	**-0.83**	**-0.91**	**0.20**	**1.221**	**1.084**	**1.148**	**0.097**	**0.953**	**0.812**	**0.003**

Table V. The result of reactive power flow

Line Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Power Flow without UPFC	**0.406**	**0.055**	**0.028**	**0.186**	**0.207**	**0.169**	**-0.08**	**-0.03**	**-0.10**	**0.210**	**-0.56**	**0.286**	**0.655**	**0.443**	**0.344**	**0.539**	**-0.06**	**-0.16**	**-0.28**	**0.613**
Power Flow with one UPFC	**0.573**	**0.053**	**0.027**	**0.162**	**0.203**	**0.163**	**-0.079**	**-0.028**	**-0.091**	**0.219**	**-0.422**	**0.247**	**0.691**	**0.543**	**0.274**	**0.568**	**-0.073**	**-0.198**	**-0.343**	**0.592**
Power Flow with two UPFC	**0.495**	**0.278**	**-0.01**	**0.188**	**0.188**	**0.150**	**-0.06**	**-0.06**	**-0.59**	**0.206**	**-0.61**	**0.254**	**0.711**	**0.596**	**0.222**	**0.583**	**-0.071**	**-0.191**	**-0.311**	**0.618**

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RESEARCH ARTICLE

Electrical Vehicles Parking Optimal Allocation and Capacity Based on Combination Optimal Voltage Profile, Harmonic and Losses Reduction by using Intelligent Algorithms

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ABSTRACT

Adding parking by a random and unmanaged method, due to storage devices, can lead to adverse effects on the network. Devoting a wrong place for parking where is used as distributed generation may increase the network losses and voltage profile degradation. However, the optimal localization of the parking reduces system losses and harmonics, and increases system reliability and voltage stability margin.Also, because the electrical vehicles parkings can be used as a load and a source, they can help flatten the load curve of networks. In the meantime, the determination of suitable parking capacity for securing the network in terms of loading vehicles from network is also one of the important issues to be confronted. Layout and location of parking in the network have an impact on the parameters such as power losses, voltage profile and network harmonic. The purpose of this paper is to define comprehensive algorithm using genetic algorithm1 to optimize the localization and parking capacity for electric vehicles in the network so that in this network, losses are minimum, the voltage profile is maintained and total harmonic distortion is minimum.

Key words: electric vehiclesparking, voltage stabilizing, distributed generation, Loss reduction, reduction of harmonics the optimal allocation.

INTRODUCTION

In the last years, hyper-emission of greenhouse gases by factories and internalcombustion vehicles have caused unprecedented changes in earth's climate. Reduction of pollutants and low cost of electricity in electric vehicles compared to fossil fuels per distance has caused electric vehicles to become a viable alternative for internal combustion vehicles.

If some electrical vehicles that can connect to the network in a coordinated manner under the management and control of a collector entity such as an electric vehicle parking connect to the network, can act as a small virtual powerhouse or distributed generation center that has a very high launched speed and without any setup fee. The parking positions are important for electricity distribution companies from the perspective of losses and voltage and network harmonics.

In plug-in hybrid electric vehicle impact on network load curve, generating capacity, costs and the greenhouse gas emissions level have been studied. In [2], [3] and [4] references the units participation problem considering the connecting ability of electrical vehicles to the network has been optimized by the using particle swarm algorithm. In this article, the duration of vehicles' connectivity to network has not been considered. In [5] and [6] the presence impact of PHEV on minimizing the distribution network losses from the perspective of the distribution network operator and also electric vehicles' connection to the network in order to meet the reserve and frequency regulation has been evaluated respectively.

In [7] and [8] it's demonstrated that by adopting intelligent strategies in operation of EVs, the undesirable impact of these vehicles on the system power is reduced. Reference [9] has performed multi objective EVP locating in order to improve the voltage, reliability and cost reduction, regardless of the automotive battery bhargermodel. In [10, 11] the parking locating has been done to reduce power dissipation regardless of possible EVP models and the battery need for recharging.

Reference [12] located and determined the capacity of EVP and distributed generation sources to charge the battery, by using genetic algorithm and Monte Carlo simulation. Reference [13] has also determined the capacity and location of EVP for EV battery charge.

As it was seen, most of introduced resources were as a single objective and done optimization only for one constraint. The aim of this article is to obtain multi objective algorithm that we can locate the EVPs in the distribution network by using it in such a way that:

The network losses be minimized
The voltage profile be preserved
THD be minimized.

Problem Statement

Desirable allocation of location for parking in the network is very important. Installing and commissioning in non-ideal locations can increase system losses and subsequently increasing the costs and adversely affect the distribution network. Selecting the best location for installing and commissioning of these parking in large distributed systems, is a complex combinatorial optimization problem. The use of this parking will be followed by technical, economical, legal challenges and probably will have environmental problems. Parameters , capacity, reliability, power dissipation, voltage, power quality and load demand are associated with the operation and investment; so a general

method for determining the optimum location of the parking is necessary to make sure that their effect on the distribution systems is positive and minimize the power grid losses and maintain the voltage in an acceptable level.Therefore the overall objective of defining a comprehensive algorithm for optimal localization of electric vehicles parking in the distribution network is in such a way that the voltage profile will be improved, losses will become the minimum and total harmonic distortion will be reduced.

Objective Function

Losses

One of the important parameters of a power is system loss that determines optimal level and efficiency and the costs of long-term operation of the system. The difference between the input energy and the used energy refers to energy losses. The studied network is a subset of distribution network and so system losses will be considered due to lines ohmic resistance [11] and we describe it by the following equation:

$$P_{loss} = \sum_{b=1}^{B} R_b * I_b^2 \qquad (1)$$

Where P_{loss} is distribution system, R_b is resistance for the b-th line, I_b is the b-th line of current and B is the total number of lines in the system.

Voltage Profile

Ideally the size and buses voltage of distribution network is a pu (Per-Unit). The lower the difference in size of the system bus voltage is than 1 pu, the network will have the better voltage profile. To enter the voltage profile into the objective function directly, we define the Profile variable as follows:

$$Profile = \sum_{i=1}^{N} (v_i - 1)^2 \qquad (2)$$

Which Profile variable indicates status of the voltage profile, v_i is the i-bus voltage, N is the number of system buses.

By investigating the above equation, we understand that the better network voltage profile is, the smaller Profile variable will be, and in ideal case that all of the bus system voltages are a per-unit, its value is zero.

Total Harmonic Distortion (THD)

Using nonlinear loads in the industry will increase the level of harmonics in distribution and transmission networks. Harmonics have devastating effects on electrical network equipment (transformers, capacitor banks, motors, etc.), including increased losses, reduced efficiency, lifetime, occupied capacity and creating unwanted resonances in the network. Electric vehicles' parking are the sources of harmonics due to the power electronic devices including inverters, therefore THD increases network voltage.

Total harmonic distortion that is abbreviated as THD is criteria for measurement of harmonic distortion that is defined as follows [14]:

$$THD = \frac{\sqrt{v_1^2 + v_2^2 + \cdots + v_n^2 + \cdots}}{v_1} \quad (3)$$

In the above equation v_i is equal to the RMS of the i-th harmonic.

Constraints of Distribution System

Installation of electric vehicles' Parking should be such that the performance of distribution system has not been in a trouble. Two major constraints, thermal limits of distribution lines and size limits of buses voltage system besides the maximum allowable THD of system's bus voltage must be observed while the parking is installed in the distribution network so network performance will not be disrupted. In the following governing constraints of the localization of the problem and optimization sizing of electric vehicles' parking will be considered.

Thermal Limitation Constraint of Distribution Lines

Transmission lines of distribution network have power transmission limits and the transmitted power from them must be less than or equal to their maximum capacity. This constraint is expressed as follows:

$$S_{i,j} \leq S_{i,j\,max} \quad (4)$$

Which $S_{i,j}$ is the transmitted power from the transmission line between i and j buses and $S_{i,j\,max}$ is the maximum allowed capacity for it.

Limitation Constraint of Buses Voltage

The size of the system buses voltage must remain within its allowed range, the constraint is expressed by the following equation:

$$v_{i,min} \leq v_i \leq v_{i,max} \quad (5)$$

i=1, 2… N

Where in the above equation, N is the number of system buses, v_i is the size of i-th bus voltage the and $v_{i,max}$ and $v_{i,min}$, respectively, are its allowed maximum and minimum voltage.

Maximum Allowable CapacityConstraint of Parking

Electric vehicles parking capacity is equal to the number of cars entering the parking lot simultaneously and can be connected to the charging and discharging. Each parking has its own unique capacity and its capacity should not be exceeded from its permissible limit.

$$CP \leq CP_{max} \quad (6)$$

This relationship suggests parking capacity constraints. That CP is the installed parking capacity and CP_{max} is the allowed maximum capacity of parking.

Maximum Allowable THD

The THD network voltage value must be less than THD_{max} maximum specified standard value where shown in Table 1.

$$THD_i \leq THD_{max} i = 1,2, \ldots ,N \quad (7)$$

Where, THD_i is i-th bus THD. THD_{max} value depends on the distribution system voltage level and is mentioned in the standard of IEEE Std.519-1992 [15].

Optimization Implementation

We express optimal locating problem of the electric vehicles' parking into a constrained optimization problem and we use genetic algorithms in order to solve it.

While working with evolutionary algorithms (e.g. genetic algorithms) to optimize a specific issue, the question first must be stated in terms of a cost function. In other words, optimization objectives should be expressed as a function that by minimizing it, the intended objectives can be met. This function is called cost function.

The objective function can be assessed as follows and in the form of three factors such as Profile, P_{loss} and THD:

$$F = Z_1 * Profile + Z_2 * P_{loss} + Z_3 * THD \quad (8)$$

In the above equation, the three coefficients Z_1, Z_2 and Z_3 are weighting coefficients. That Z_1 is the weighting factor of voltage profile, Z_2 is the weighting factor of losses and Z_3 is the weighting factor of THD voltage in the objective function and F is also the objective function. The size and installed location of parking should be in a way that the defined F be minimum and listed constraints also be respected.

Introduction of network Test

To apply the proposed method we use a 9-buses distribution system that is drawn in the single-line diagram figure 1 and the complete information system can be seen in [16].The voltage level is 33 KV and nominal power is considered 1000 MVA. This system is connected to the network via bus No. 1, with a 132/33 KV transformer. Except bus No. 1, all the buses have loads that their information is mentioned by the line information of transmission system which is shown in Table 2.

Power coefficient of all loads of system is 0.9 lagging and the maximum capacity of each line is 25 MVA. By using the following equation, the reactive power consumed by the system buses is obtained.

$$Q = \frac{\sqrt{(1 - PF^2)}}{PF} \quad (9)$$

That PF is the power factor, Q is reactive power of bus and P is active power of bus.

The graph of load changes for each of the 8-bus system during the 24-hour system is as figure 2.

We consider the system load into three-level, so we know:

- The hours of 12 PM to 7 AM as the Low load hours with the level1load
- The hours between 7 AM to 8 PM as the mid-load hours with the level2 load
- The hours Between 8 PM to 12 PM as the Rush load hour with the level3 load

Simulation Assumptions

In this case of study, the following assumptions have been taken:

The responsibility of installation and operation of electric vehicles' parking are on the distribution company.
The electric vehicles' batteries are charged with constant power of 15 KW.
The system load is Time-varying and is considered at three levels (low, medium and high).
Reactive power of parking is zero and active power consumption at the time of discharge is considered positive and negative during the charge.
All vehicles are charging and discharging with a maximum nominal power.
The charging of battery is expressed with battery SOC that is the ratio of the energy to the total energy capacity of the battery:

$$SOC = \frac{Energy\,in\,battery}{TotalEnergyCapacity} \quad (10)$$

It is assumed that the initial charging of vehicles (SOC) is in the three levels. It is assumed that, as an example, 25 percent of all vehicles have SOC = 0.3, 25% have SOC = 0.45 and 50% also have SOC = 0.7 and only 3 charging level is taken into account for vehicles.

In the paper it is assumed that all vehicles have equal or in the other words similar storage capacity.

As the battery capacity of the vehicle itself is very small, so it is assumed that vehicles enter the parking as a group.

During the 24 hours of a day, hours 1 to 7 is considered as a low load hours, 7 to 20 as the mid- load hours and 20 to 24 as load hours of system.

The charging and discharging simulation

Since our main objective is to locate parking for electric vehicles in the network, so we should study the electrical behavior of electric vehicle in the charging and discharging processes.

The output power of parking depends on primary SOC of vehicles, their numbers and also the charging and discharging of vehicles. The required time to fully charge of i-th electric vehicle t_i is calculated as follows and is a function of the initial charge SOC_i, the battery capacity ES_i and that the power that the vehicle can be recharged with P_v:

$$t(i) = \frac{(1 - SOC_i) * ES_i}{P_v} \quad (11)$$

The output power of parking P_{park} is as below, which n is the number of cars in the parking lot:

$$P_{park} = P_v * n \quad (12)$$

By assuming three primary charge levels of SOC_1, SOC_2 and SOC_3, three times of t_1, $t_2$and t_3 for full charge of vehicles are achieved respectively, which we can modeling the electrical behavior of parking during charging of electric vehicles by using them and Figure 3. Which n1, n2, n3 are the numbers of vehicles with state of SOC_1 SOC_2 and SOC_3 charge respectively. Since $t_1<t_2<t_3$ so $SOC_3 < SOC_2 < SOC_1$.

The discharge relation is expressed by the following equation:

$$t(i) = \frac{(SOC_i) * ES_i}{P_v} \quad (13)$$

It is because in the process of discharging, the total energy in battery of electric vehicle should be unloaded and delivered to the network. Initial charge of i-th vehicle is SOC_i is and the total charge of its battery is ES_i. Therefore their multiplication indicates the amount of energy in the battery that the battery's discharge time can be determined by dividing into discharged power P_v. Graph of power versus discharge process time is such as figure 3, with the difference that the power is symmetrical. It is because in this case the parking lot delivers the electrical power to the network.

Information relating to the SOC of electric vehicles is in the table3.

The number of vehicles is equal 400 and the charging and discharging power of vehicles in accordance with Article [9] is 15 kW and a capacity is also 50 kwh. So with these assumptions, the diagram of power versus parking lot in the process of charging and discharging is according to the Figure 3.

Electric Vehicles Parking Simulation

Figure 5 shows the model of electric vehicles in the process of charging parking.

The simulation results

First the impact of any constraint on the objective function is evaluated individually. For example, in order to investigate the effect of voltage profile constraint, we suppose that Z1 weight coefficient equals to 1 and the rest of the coefficients equal to zero and are simulated by genetic algorithms. We repeat this method for losses and also THD constraints. Then we consider Z_1, Z_2 and Z_3 parameters equal to 0.33 in the objective function in order to make the constraints impact of the issue equal and we do the simulation by genetic and bee and PSO algorithms. In the genetic algorithm the maximum number of birth is 50 and the initial population is considered 20. PSO algorithm has been simulated by the maximum repeat of 50 and with a particle population of 20. In this algorithm ABC bee population are assumed 20 and number of algorithm repeat is assumed 50.

As you can see in all conditions the voltage profile and losses are improving compared to the situation without the presence of parking. Due to the presence of electronic devices the increase of power by parking in harmonics generation is inevitable. Therefore with the presence of parking, THD will increase. Table 5 shows the improvement rate of parameters.

The best average improvement is due to a combination constraint.

Each bus number and the optimal capacity for the parking installation are as follows:

Verification

As mentioned by presence of parking lot, harmonics caused by power electronics devices, will increase. And according to the obtained results of Table 4, increase of THD in the presence of parking compared to the lack of parking confirms the validity of results. According to Table 6 appropriate buses for parking installation, are the buses that the voltage profile is improved in them due to the existence of power source caused by the battery of electric vehicles in the parking lot. Intelligent algorithm is completely random and the results of each algorithm running may be different with the next run. Simulation results as shown in Table 5, voltage profile and losses improved in all constraints that this case is the best optimality in the Hybrid constraints.

CONCLUSION

In this paper, a new method to optimal locating and the capacity of electric vehicles' parking and DGs has been provided. According to the results of the sources modeling and comparing the results with the results of [9] it has been specified that the performed simulation has a very high accuracy and the results confirmed that the relocation of parking in the network will change the losses and the profile voltage situation. By determining the optimal location and capacity of the parking we can improve the general conditions of the system with clearing profile voltage and reducing losses. The parking nature and some other DGs are so that generates harmonics, if the location and size of parking are optimal**,** THD will also be reduced.

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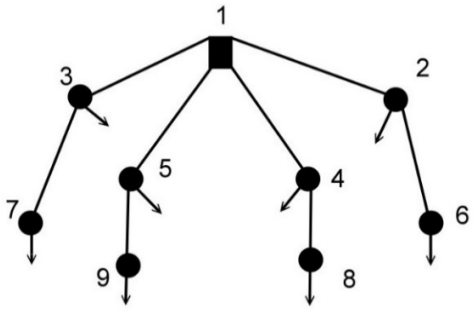

Figure1. 9-buses Distribution System

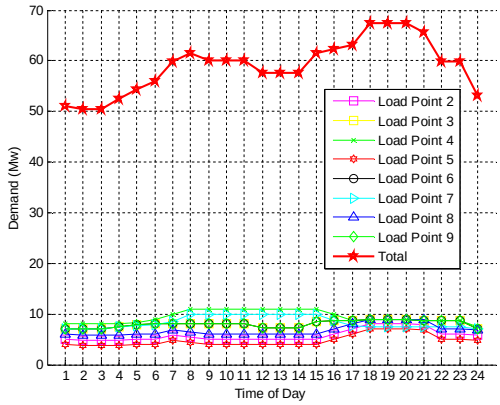

Figure2. Load changes graph for a day and night

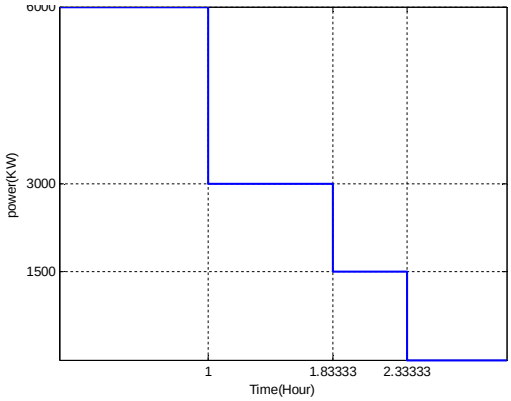

Figure 3. Graph of power versus parking in charging

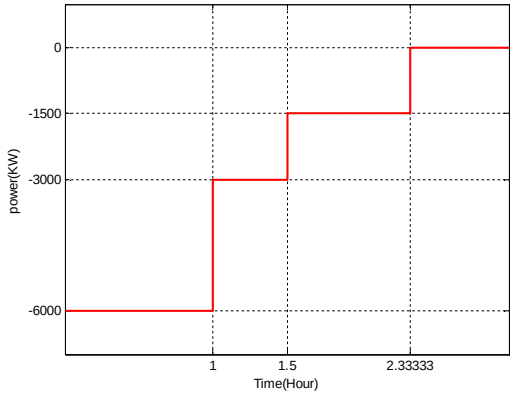

Figure 4. Graph of Power Versus Parking in Discharge

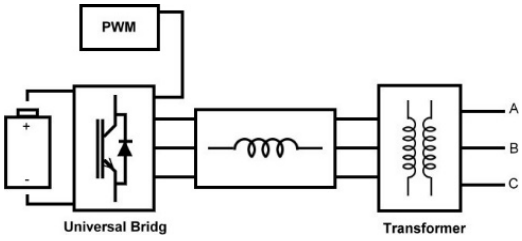

Figure5. The Model of Electric Vehicles' Parking Simulation

Table1. The Harmonic Distortion Voltage

Bus voltage	THD(%)	THDtotal(%)
$69KV \leq V$	3.0	5.0
$69.001KV \leq V \leq 161KV$	1.5	2.5
$161.001KV \leq V$	1.0	1.5

Table2. Test Network Profile

Region		R_L (Ω)	X_L (Ω)	Distance (KM)	Level1 (MW)	Level2 (MW)	Level3 (MW)
1	3	1.4	1.5	1.5	5	6	8
3	7	2.78	5.5	5.5	7.5	8.8	9.2
1	2	2	4	4	8.3	11.2	9
2	6	2.8	5.5	5.5	4	5	7
1	5	1.7	1.7	1.7	7.5	8.8	9.2
5	9	2.1	4	4	7.3	10.2	8
1	4	2.26	4.5	4.5	6	7	9
4	8	2.4	5	5	7.5	8.7	9.2

Table3. The initial charge and the number of electric vehicles during a day

initial charge	0.3	0.45	0.7
Vehicle number	%25	%25	%50

Table4. The situation of objective function parameters by applying different constraints

Genetic	**Voltage Profile constraint**	**Voltage Profile**	0.066428
		Loss	3.0667
		THD	0.43424
	Loss constraint	Voltage Profile	0.067111
		Loss	3.0506
		THD	0.31715
	THD constraint	Voltage Profile	0.067581
		Loss	3.0975
		THD	0.28703
	Combined constraint	Voltage Profile	0.65915
		Loss	3.0097
		THD	0.32465
	Without Parking	Voltage Profile	0.074538
		Loss	3.3364
		THD	0.15052
PSO	Combined constraint	Voltage Profile	0.066288
		Loss	3.0604
		THD	0.43421
	Without Parking	Voltage Profile	0.074538
		Loss	3.3364
		THD	0.43421
ABC	Combined constraint	Voltage Profile	0.066405
		Loss	3.0760
		THD	0.32036
	Without Parking	Voltage Profile	0.074538
		Loss	3.3364
		THD	0.15052

Table5. The improvement of voltage profile and losses parameters

Genetic	**Voltage Profile constraint**	**Voltage Profile**	10.8808
		Loss	8.0826
	Loss constraint	Voltage Profile	9.9648
		Loss	8.5643
	THD constraint	Voltage Profile	9.3342
		Loss	7.1591
	Combined constraint	Voltage Profile	11.5684
		Loss	9.7897
PSO		Voltage Profile	11.0684
		Loss	8.2716
ABC		Voltage Profile	10.9111
		Loss	7.8036

Table6. The location and size of optimal parking

Genetic	Bus No.	3	6	8
	Optimal Capacity	278	202	244
PSO	Bus No.	6	2	8
	Optimal Capacity	127	188	244
ABC	Bus No.	2	9	8
	Optimal Capacity	511	60	234

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REVIEW ARTICLE

Establishment Methods for Sustaining the Productivity of Lowland Rice in Irrigated Ecosystem – A Review

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ABSTRACT

Rice is established in different ecosystems *viz*., irrigated, rainfed lowland, upland and flood prone. The rice production has to be enhanced to meet the food requirement of the growing population by improving the agronomic practices. The need to improve agronomic practices has emerged because of diminishing and unreliable water supplies, increasing cost of fertilizer, and the increased labor scarcity. Good crop establishment is one of the key components of agronomic practices for efficient use of resources and inputs and consequently for achieving desired level of productivity. Transplanting is the most popular method of lowland rice establishment in irrigated areas. In recent years, direct seeding has been promoted as a replacement for transplanting to address the problem of labor scarcity and high water demand. Moreover, proper row arrangement and appropriate inter and intra row spacing are important for improving the crop growth, sink capacity and ultimately the yield of rice. Thus, system of rice intensification (SRI) in transplanted condition and direct planting system (DPS) in direct seeded condition pave a way to sustain the productivity of lowland rice in irrigated ecosystem.

Key words: Irrigated rice, establishment methods, direct seeding and transplanting

Rice (*Oryza sativa* L.) is the staple food of more than half of the world's population. World's rice production should increase to 880 million tons in the year 2025 to meet the rice demand of the burgeoning population [1]. The rice production can be enhanced with improvement of agronomic practices and introduction of high yielding cultivars. Rice is grown in different ecosystems. International Rice Research Institute classifies four broad ecosystems - irrigated, rainfed lowland, upland and flood prone [2]. There are several options to establish rice in each ecosystem depending on soil, water, labour availability and other infrastructural facilities in different parts of rice farming areas in the world. Under irrigated ecosystem, the crop is established either by transplanting of seedlings raised in a nursery or by direct seeding of sprouted seeds on puddled soil. Transplanting is the most dominant and traditional method of crop establishment in irrigated lowland rice. Transplanted rice is practiced in areas with low wages and adequate water, whereas direct seeded rice can be practiced in areas with high wages and low water availability [3].

Looming water crisis, water intensive nature of rice cultivation and escalating labour costs drive the search for alternate crop establishment methods to increase the productivity of rice cultivation [4]. The innovative systems of rice cultivation such as System of Rice Intensification (SRI) and are being evolved to increase the productivity of irrigated rice. Direct Planting System (DPS) in which desired plant density (25 cm x 25 cm) like SRI is maintained by thinning the direct seeded rice with manual and mechanical means (rotary weeder) [5].

Effect of Rice Establishment Methods on Growth Parameters

Wet seeded rice starts tillering earlier than transplanted rice because its growth proceeds without the set back caused by uprooting injury to the root of seedlings [6]. Direct seeding of sprouted seeds under puddled condition favourably influenced the growth parameters of rice *viz*., plant height, tiller production, dry matter production, root length and volume, root penetrations due to favourable soil moisture regime than direct seeding of sprouted and dry seeds under unpuddled condition [7]. Rice plants grown in drum seeding (wet bed and unpuddled) had higher accumulation of dry biomass of shoot and root than the plants grown in manual and mechanical transplanting (puddled) [8].

Placing of single seed or two seeds at 5 cm apart was found to produce higher biomass than placing the seeds together in line with the spacing of 25 cm x 25 cm. The biomass produced under the broadcasting was almost 52 per cent of the single seed placed at 25 cm x 25 cm [9]. Direct planting system recorded with more tiller, white roots, root volume, root length density root mass density than drum seeded rice on hill basis [10]. The roots of rice plants have least competition under wider spacing so that growth is stimulated by sunlight and space for the canopy expansion [11].

With SRI, plant roots can spread in all directions, and all leaves receive enough sunlight to be photosynthetically active. The closer planting i.e., conventional practice leads to constrained tillering and to shading of plants' lower leaves which makes them senesce early, especially from the latter phase. These leaves become ineffective, parasitic, consuming from the plant's supply of photosynthates rather than contributing to it [12]. In cluster planting (two or four seedlings together), there were initially more primary tillers and ultimately lesser tillers per hill due to mutual competition [9]. Root dry weight and root volume were significantly higher in SRI than conventional method, irrespective of varieties during wet season [13].

During *kharif*, the combination of young seedling, one seedling, square planting and conoweeding showed its superiority by registering more tillers m^{-2}, dry matter production, root length, root dry weight and root volume [14]. New tillers in modified SRI emerged flatter, i.e. with a greater angle from the vertical, whereas conventional practices' tillers emerged more upright within the clump of plants. Modified SRI leaves were more erect as compared to conventional practices [15].

Effect of Rice Establishment Methods on Physiological Characters

Net photosynthesis was higher in SRI as compared to conventional practices [12]. They further stated that the transpiration rate in SRI was lower than conventional practices. The interception of light was almost equal in drum seeding and broadcasting [16]. The recommended management practices' canopy intercepted more solar radiation than the modified SRI canopy up to 40 days after germination. However, beyond 50 days after germination, the trend was reverse [15]. The DPS rice had higher chlorophyll content than drum seeded rice [10].

Enhanced root activity during the entire growth period, especially during later growth stages; higher contents of soluble sugars, non-protein nitrogen and proline in leaves, higher translocation and conversion rates of stored matter from vegetative organs were observed in plants under SRI. This ultimately enhanced grain filling and spike weight in SRI [17].

Effect of Rice Establishment Methods on Rice Phenology

Transplanting shock resulted in longer (about 8 days) duration of the transplanted rice than direct-seeded rice during both wet and dry seasons at IRRI, Phillipines [1]. Drum seeded rice matured in 130 days whereas direct planting system took 134 days for maturity [10]. The rice under SRI was found to mature 3-10 days earlier than traditional practice [18] [19]. The combination of younger seedlings, closer spacing and conventional weeding had synergy in terms of early flowering than the combination of wider spacing and mechanical weeding [20]. The combination of young seedling, one seedling, square planting and conoweeding exerted 50 per cent panicles seven days earlier than the combination of normal seedling, one seedling, rectangular planting and hand weeding [21].

Effect of Rice Establishment Methods on Yield and Yield Attributes

Direct seeding of sprouted seeds under puddled condition enhanced the number of panicles m^{-2} which resulted in higher grain yield [7]. Direct planting system gave higher grain yield as compared to conventional transplanting [16]. Direct planting system recorded more yield attributes and grain yield as compared to drum seeding [10] [22].

When all the four components of SRI *viz*., young seedling, one seedling, square planting and conoweeding were combined, it gave the improved yield attributes which ultimately resulted in higher grain and straw yield and harvest index during *kharif* [23]. Ninety-four percent tillers produced panicles in modified SRI whereas 89 per cent in conventional practices [15]. The square geometry with wider spacing, planting of single seedling $hill^{-1}$ (SRI) was found to reduce the above and below ground competition, enhanced solar radiation interception and nutrients uptake which resulted in more number of grains $panicle^{-1}$ and grain yield [24].

Effect of Rice Establishment Methods on Nutrient Use Efficiency and Soil Available Nutrients

Plant nutrient uptake and nutrient accumulation ratio was higher in SRI than conventional practices [25]. Direct planting system had shown higher utilization of nutrient than drum seeding [10]. SRI resulted in higher productivity during *kharif* with comparable nutrient uptake and marginally higher nutrient use efficiency without depleting the soil available nutrients compared to standard transplanting [26]. The nutrient uptake was higher in drum seeded rice than wet and dry seeded crop [27]. When all the four components of SRI *viz*., Young seedling, One seedling, Square planting and Conoweeding (YOSC) were practiced, it resulted in higher nutrient uptake, nitrogen harvest index and more soil available nitrogen, while the soil available P and K did not differ significantly due to different SRI practices [23]. On the contrary, SRI had lower NPK in post harvest soil because of better nutrient uptake by plants [28].

Effect of Rice Establishment Methods on Microbial Population

The CFU g^{-1} soil of total bacteria, fungi, actinomycetes and *Azotobacter* were high in SRI compared to normal practice of rice cultivation. The phosphorus-solubilizing bacteria were found to be less in SRI compared to conventional method [29]. More number of bacteria and fungi were found in Integrated Crop management (ICM) and SRI, respectively [30]. More number of *Phosphobacteria* was found in standard transplanted rice and flourescent *pseudomonads* in ICM. The active soil aeration due to SRI water management practices can enhance the growth of phosphobacteria and possibly of N-fixing bacteria by alternatively wetting and drying the soil [12]. Direct planting system greatly influenced the colony of microbes to build near the rhizosphere than drum seeding [22].

Effect of Rice Establishment Methods on Labour Productivity

Drum seeding method required only eight persons whereas line sowing of sprouted seeds and transplanting methods required 20 and 40 person ha^{-1} respectively. Thus, there is a significant saving of labour in the drum seeding method [31]. Direct sowing either by broad casting or drum seeding employed less number of labourers of 2 man days ha^{-1} for sowing whereas it required 40 man days ha^{-1} for weeding. Though line transplanting required more labourers (52 man days ha^{-1}) for transplanting, it took only for 24 man days ha^{-1} weeding [32]. The direct planting system saved 60 per cent labour as compared to conventional and SRI practices [5]. Wider spacing required less number of labour for weeding and transplanting [33]. Labour productivity was high for younger seedling from dapog nursery (14 days old) and wider spacing combination [20].

Effect of Rice Establishment Methods on Weed Dynamics

Among the rice establishment methods, drum seeding method had minimum density and dry weight of weeds at 45 and 60 DAS, Nutrient uptake by weeds at 60 DAS and maximum weed control efficiency than wet and dry seeding [27]. Direct planting system recorded less total weed dry weight and nutrient removal by weeds over drum seeding. However, weed control efficiency was similar for both the establishment methods [34]. Transplanting recorded the lowest weed population and weed dry weight followed by the puddle sowing of sprouted seeds and dry drilling [35]. Weed population and weed biomass was more in SRI than standard transplanted rice [30].

Effect of Rice Establishment Methods on Energetics

The total energy output and energy use efficiency were higher in drum seeding as compared to line transplanting and broadcasting [36]. The SRI establishment technique recorded higher energy output: input ratio than transplanting and aerobic techniques [37].

Economics of Different Rice Establishment Methods

Direct seeding practices *viz.,* wet seeding by manual broadcasting and drum seeding recorded higher net income and BCR against the conventional transplanting [38]. Drum seeding was more effective than wet and dry seeding of rice in realizing higher net returns and benefit: cost ratio [27]. Direct planting system recorded higher gross return, net return and B: C ratio [34]. Combination of young seedlings, single seedling, square planting and conoweeding registered the highest net return and BCR compared to conventional practice [39]. The SRI had more economic advantage in terms of gross return and B: C ratio as compared to transplanting and aerobic techniques [37]. The SRI planting and two way rotary weeding recorded the highest BCR with recommended dose of fertilizer and highest net return with RDF, FYM and biofertilizers *viz., Azophosmet* and PPFM [40]

CONCLUSION

The rice production has to be enhanced with good management practices to meet the food requirement of the growing population with shrinking availability of land and water resources. From the foregoing literatures cited, it is concluded that the traditional establishment methods can be substituted with the alternate crop establishment methods *viz*., system of rice intensification (SRI) under transplanted environment and direct planting system (DPS) under direct seeded condition for achieving the sustainability in rice productivity and soil health besides reducing the utilization of resources.

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RESEARCH ARTICLE

A Comparative Study of HVAC and Radiant Systems for Heating Buildings in Different Climates of Iran

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ABSTRACT

In the present study, a novel algorithm is presented for energy simulation of a building equipped with solar radiative panels using a combination of a new dynamic CFD simulation approach (direct modeling simulation) and genetic optimization algorithm. The direct modeling simulation is initially implemented to analyze thermal behavior of the building using finite–volume numerical scheme. The optimized results of temperature field are determined using genetic optimization algorithm in each time step. Using a combination of genetic algorithm and bulk model, the optimized bulk temperature data is calculated, which is used as input data to enter energy consumption simulation algorithm in order to calculate energy consumption for buildings. The results of energy consumption are reported for several different climates in Iran. To verify the accuracy of present study, the results of numerical optimized code are compared with the results of Carrier and Energy–Plus software. The results show a good agreement between numerical and software solutions, which indicates that solar radiative panels can work as an efficient applicable heating equipment for different climates in Iran.

Keywords: Numerical analysis, Energy simulation, HVAC

INTRODUCTION

The design of buildings with optimum performance becomes an influential demand in residential zones all over the world. The optimized performance of building components can directly lead in energy saving inside buildings, which indirectly reduces energy loss of residential zones. In order to achieve energy saving concept, there are a number of different efficient energy systems with high technologies used in buildings, which cause to make suitable indoor thermal comfort inside residential zones. The efficiency of these building energy systems depends on how suitable they can improve thermal comfort inside buildings with the least possible financial cost in design phase. To achieve thermal criteria and efficient performance, a number of heating/cooling equipments are used inside buildings, which are mainly divided into two groups known as HVAC systems and radiant systems. Both HVAC and radiant systems have considerable energy consumption rate in buildings. Therefore, there is a growing need to present efficient energy systems for heating/cooling buildings with the least possible energy loss during the year.
There is an increasing demand for designing more complex and reliable heating systems inside residential buildings throughout cold seasons. The heating systems should not only work efficiently but also have low financial cost regarding their maintenance and initial installation. Thus, it is necessary to select proper heating systems with efficient performance and low financial budget cost.

In order to design efficient heating systems, there are a number of different approaches used to simulate thermal analysis of buildings such as experimental approaches that are quite limited to several special issues due to their intense financial cost. It is sometimes impossible to perform numerous experiments to determine building design parameters for presenting a suitable design. The preciseness of experimental measurement is also considered as an important issue in building design phase. The results of experimental measurement can contain some unbalanced data due to error in device measurement. According to these disadvantages, researchers prefer to utilize new applicable approaches, which are not only precise but also have reasonable financial budget. Due to these limitations, the use of numerical simulation are becoming more popular among researchers, who work on building design problems. Numerical approaches are able to design energy systems with the use of computational codes more precisely than experimental devices. Based on numerical approaches, there are a number of commercial software packages presented that are capable of simulating thermal behavior of buildings with acceptable preciseness. Before using any package, one should be aware of the quality and specially quantity of several parameters which play crucial role in calculating heating loads and energy consumption in buildings. Commercial software packages are usually capable of simulating energy systems in a finite number of special issues because of steady state nature of their analysis. Therefore, it is strongly recommended to utilize numerical code instead of the use of commercial software in order to confirm the excellent preciseness of the building design. The other important factor in building design phase is to select a suitable heating equipment for buildings. In order to select a proper heating system, it is crucial to determine weather condition in the sample climate, where the building is constructed. There are several other factors that play crucial role in building design phase such as conduction and convection heat transfer coefficients, area of walls, thermo-physical properties of walls, building area, heating equipment and boundary conditions. It is evident that the results of building design does not have suitable accordance with real situation, if these design factors are not considered in building design phase. In order to consider all of these design factors, it is common to use energy modeling to improve the performance of different building components. In fact, energy modeling is a key tool to determine a precise estimation of heating load calculation and energy consumption of buildings. There are many different energy models presented during the last two decades in order to analyze building thermal behavior. The choice of using these energy models depends on what one needs to calculate and which input design data are available in the problem.

Over the last four decades, a number of impressive researches have been published on energy modeling and building thermal analysis in the open literature. Some of these works are investigated with the use of numerical methods.

Early works were conducted by ASHRAE in 1963. Stephenson and Mitalas [4] investigated cooling load calculations by TRM method. With the development in new technologies and use of personal computers in the early 1980, energy modeling was remarkably investigated once again in buildings. In this period, a considerable financial budget was dedicated to energy modeling in buildings by the American department of energy (DOE), which results in creating a number of different building energy simulation programs such as DOE-2 and TRNSYS. Note that most of these programs remained unprofitable in research laboratories due to its complexity for use and rather high financial cost. The other heating/cooling load modeling was presented by Pedersen et al. [5] using a dynamic load calculation in 1990. Hensen [6] presented the results of system simulation for building performance evaluation. Andersen [7] investigated stochastic modeling of energy systems in buildings to present mathematical formulation for some heating equipment such as radiators. Once in the past, energy modeling calculation was conducted using trial and error methods, which leads to inaccurate heating/cooling load calculation and selection of unsuitable HVAC systems with low energy efficiency. To present a complete accurate load calculation, one has to consider all the complexity exists in building modeling. This actuated researchers to use dynamic computer simulation in building modeling. Baoping et al. [8] investigated dynamic simulation of heating system with radiators with thermostatic control valve. Tzivanidis et al. [9] demonstrated the results of numerical simulation to predict cooling energy consumption in Athens buildings. De Carli et al. [10] investigated a numerical model for thermal balance in a room with radiant systems. Neto et al. [11] presented a comparison between the results of numerical simulation of energy-plus software and artificial neural network forecasting building energy consumption. There are a number of works, which were conducted regarding optimization analysis in buildings in the literature. One of these works was done by Siddharth [12] who investigated automatic generation of energy conservation measures in buildings using genetic algorithm. Lee and Cheng [13] defined a simulation-optimization approach for energy efficiency of buildings. Hence, all these works were done to analyze energy modeling and load calculation with the use of different numerical methods.

The above literature review shows that a number of studies were done regarding building energy modeling with the use of commercial software. The commercial software packages are usually capable of analyzing building design factors precisely in a finite number of special cases due to the steady-state nature of their computations. Hence, the results of energy simulation of these software are not as precise as those of numerical developed code in buildings. Moreover, there are several works, which are not financially worth enough to be implemented practically in the building industry, because these works designed buildings in ideal conditions. Some previous sources of studies lacks useful information concerning building design, which are presented as follows. There are few sources of research papers that the thermal analysis of HVAC and radiant heating systems are presented numerically inside buildings. In few published works, the performance of HVAC and radiant heating systems are compared with each other inside a sample practical example for several climates.The main purpose of the present study is to present an applicable numerical approach for energy simulation inside residential buildings. In the present study, we present a comparison between different heating systems such as HVAC equipment and solar radiant systems in a sample building in several climates of Iran. This is definitely an important result in building design problems, because one is able to analyze building design problems with excellent preciseness with the least possible computational time and financial cost. Therefore, using numerical approach can not only reduce the initial financial design cost and amount of energy loss in buildings but also it can suggest a new pattern in thermal analysis of buildings to HVAC engineers to use an efficient technique instead of traditional trial and error methods in order to design buildings more precisely, which is significant.

The present study shows that how numerical coding can be utilized to simulate thermal analysis of residential buildings. Since the present work is based on a fundamental basis, instead of experimental measurements, a residential building equipped with different HVAC systems such as radiator and fan coil and solar radiant system is solved numerically for different climates in Iran. The very first step is to present a dynamic simulation of different building components. In this step, we present several mathematical governing equations for each of building components and then we solve them with finite-volume numerical scheme. The second step is to present direct modeling simulation algorithm, which is a new CFD code developed to correlate all the governing equations with

each other and solve them simultaneously. The third step is to calculate energy consumption rate inside the building. Thus, energy consumption rate is calculated for different HVAC and radiant heating systems using a new CFD developed code known as energy consumption simulation algorithm inside the sample building for different climates of Iran. The results of energy use are reported for the sample building for radiator, fan coil and solar radiative panel for different climates in Iran. To verify the accuracy of numerical developed code, the results of radiator, fan coil and solar radiative panel are compared with Carrier and Energy-Plus software for the sample building. The present study also illustrates that each of these heating equipment can work efficiently for some climate weather in Iran.

Direct modeling simulation

A number of different approaches are utilized to analyze heat transfer problems in engineering science. One of its most commonly used approaches is known as energy simulation, which is capable of analyzing a large extent of heat transfer problems such as building energy consumption. Energy simulation procedure consists of several following steps. As the first step, It is common to define all the governing equations for each sample problem, which consist of several mathematical formulations and differential equations. As the next step, one has to determine solution method to analyze all the governing equations with initial and boundary conditions.There are two major approaches to determine solution method for energy modeling known as direct modeling and inverse analysis in heat transfer science. In the first approach, thermal variables and heat transfer procedure are commonly determined using two methods known as experimental tests and numerical simulation. In experimental tests, the results have to be measured using different experimental devices inside laboratories. In numerical simulation, researchers present a mathematical model without the use of any experimental data, which consists of one or a number of differential equations that are simplified using a numerical discretization scheme and are solved through a heavy computational process and the results are demonstrated through different tables and diagrams.This solution procedure is suitable for analyzing problems with a number of input data such as system geometry, initial and boundary conditions and thermo--physical properties, which are known inside the domain. After modeling the problem, all output data are calculated using numerical simulation or experimental tests. This approach is commonly known as ``Direct modeling'' in heat transfer science. Energy consumption in buildings is an illustrative example of direct modeling.

All the direct modeling concerning building energy modeling consists of two main elements, which are presented as follows:

- Heating load modeling in buildings
- Building energy simulation

In order to simulate thermal behavior of buildings, it is necessary to analyze the previous parameters.

Direct modeling simulation

The main aim of heating load modeling is to calculate the results of heating load inside residential zones during cold seasons. In order to calculate heating load modeling, it is required to analyze the mathematical governing equations of building components presented as follows:

- Internal radiation flux modeling of walls
- External radiation flux modeling of walls
- Building heating equilibrium
- Heating equipment modeling

Each of these building components are analyzed numerically in the following sections.

Heat conduction of walls

Each building component can influence heat transfer simulation inside buildings such as walls, heating equipment, doors and windows. A great amount of heating energy exchange is transferred through walls, whose main heat transfer mechanism is heat conduction though, walls also have other types of heat transfer mechanism in buildings such as heat convection in surfaces and internal/external radiation, which have to be considered for wall simulation. Conduction heat transfer is mainly taking place due to temperature gradient between wall layers x direction, while there is almost no energy exchange in y direction, because walls have no considerable temperature gradient in y direction as it is shown in figure 1. In the present study, we use two dimensional unsteady heat conduction equation to simulate heat transfer through walls, which is presented by equation (1):

$$k\left(\frac{\partial^2 T}{\partial^2 x}+\frac{\partial^2 T}{\partial^2 y}\right)+q(x,t)=(\rho c_p)\frac{\partial T}{\partial t} \quad (1)$$

In equation (1), heat source, wall temperature field and specific heat transfer coefficient are denoted by q(x,t), T and c_p , respectively. Then, it is essential to present the boundary conditions to solve unsteady heat conduction equation. The chosen boundary conditions used for analysis are a combination of convection and radiation boundary conditions presented as follows:

- Convection boundary condition:

$$k\frac{\partial T(x,t)}{\partial x}=h[T_{air}-T(x,t)] \quad (2)$$

- Radiation boundary condition:

$$k\frac{(\partial T(x,t))}{\partial x}=\epsilon\sigma[(T_{air})^4-(T_{(x,t)}))^4] \quad (3)$$

With the use of these boundary conditions, unsteady heat conduction equation is solved using finite-volume numerical scheme.

Internal radiation of walls

Walls have internal radiation heat transfer with each other due to temperature change during a day. The internal radiative flux of walls can easily change the heating equilibrium of buildings, which is calculated by equation (4).

$$q_i - J_i - G_i \quad (4)$$

where

$$G_i=\sum_{j=1}^{n} F_{i-j}J_j \quad (5)$$

$$\rho_i \sum_{j=1}^{n} F_{i-j}J_j + E_i = J_i \quad (6)$$

In the above equations, G (W m^2), J (W m^2), T (K), A(m^2), F_{i-j} and q_i (W) are known as irradiation, radiosity, temperature profile, surface area, view factor and net radiative flux of walls, respectively. Net radiative flux is defined as the difference between leaving and incoming radiation to an arbitrary surface as it is shown in figure 2, which is simply known as internal radiation of walls in the present study.

External radiation of walls

The solar radiation are absorbed by the external walls of building during the day that are capable to change heating equilibrium of buildings. In order to consider external radiation of walls, it is necessary to use equation (7).

$$q''_{solar} = I_b \cos(0)\frac{A_{sl}}{A} + I_{dif} F_{DS} + I_G F_{SG} \quad (7)$$

where I_b is direct radiation to the walls, I_{dif} is the diffused radiation and I_G is the earth diffused radiation. External radiative flux of walls can influence heating balance in buildings. Therefore, it is necessary to consider external radiation in building heating equilibrium.

Building heating equilibrium

A great portion of heating energy exchange is transferred between walls and indoor air due to considerable temperature change during the day, whose main heat transfer mechanism is convection heat transfer. The convection heat transfer of indoor air with internal room stuffs is simply energy equation presented as follows [31]:

$$m_{air}\, cp_{air}\, \frac{dT_{air}}{dt} = Q_{air} + Q_{fur} + Q_{gen} \quad (8)$$

where heat source, mass, specific heat transfer coefficient of indoor air, convection heat transfer from walls and furniture with indoor air are denoted by Q_{gen}, m_{air}, cp_{air}, Q_{air} and Q_{fur}, respectively. To calculate indoor air convection heat transfer with walls and furniture, two following equations are implemented, respectively [31].

$$Q_{air} = \sum h_i A_i (T_{si} - T_{air}) \quad (9)$$

$$Q_{fur} = -h_{fur} A_{fur} (T_{fur} - T_{air}) \quad (10)$$

where convection heat transfer coefficient of indoor air and furniture are shown with h_i and h_{fur}, respectively. There is considerable temperature change inside furniture through heating energy exchange with indoor air due to internal temperature gradient, which is presented by equation (11).

$$m_{fur}\, C_{p_{fur}}\, \frac{dT_{fur}}{dt} = Q_{fur} + Q_{Radi,in} \quad (11)$$

where m_{fur} (kg) and $C_{p_{fur}}$ (J $kg^{-1}K^{-1}$) are known as mass and specific heat transfer coefficient of furniture, respectively and $Q_{Radi,in}$ (W) is defined as internal radiative heat flux from other furniture. All of the above equations are generally known as building heating equilibrium, which have to be solved using finite-volume scheme in order to determine temperature fields of indoor air and furniture.

Heating equipment modeling

There are many different equipments used for heating buildings during cold seasons all around the world. The heating equipments are generally divided into two main groups known as traditional heating systems such as radiators and fan coils heating equipments in central heating systems and radiant systems such as solar radiative panels. The choice of using each of these heating equipments depends on a number of different parameters such as climate weather condition, building structure and building components. In the present study, we investigate the use of HVAC and radiant systems inside residential buildings. The first step to analyze heating equipment modeling is to present differential equations govern these equipments.

HVAC heating equipments

In order to model HVAC heating equipments, it is necessary to know that each HVAC heating system working with water consists of four main elements known as heating generation source (boilers) , supply pipes, return pipes and heating equipment (radiators and fan coils), as it is illustrated in figure 3.

Heating generation source

In the present study, we use boiler as heating generation source for heating water inside the HVAC cycle and its governing equation is presented as follows [31].

$$Q_s + mc_p(1-\theta)(T_1 - T_2) + \frac{1}{2}MC_p(T_1 + T_2) = [\frac{1}{2}MC_p + mc_p\theta]T_2' + [\frac{1}{2}MC_p - mc_p\theta]T_1' \quad (12)$$

where temperature of water at (t) and (t+Δt) time periods, over-relaxation factor, leaving heating energy from water in the boiler, water mass, water specific heat transfer, water mass inside boiler and water specific heat transfer inside boiler are denoted by T, T', θ, Q_s, m, c_p, M and C_p, respectively.

Supply water pipes modeling

The supply water pipes are modeled using the following equation [31]:

$$-\frac{A_H\Delta t}{2R_H}[(1-\theta)(T_2 + T_3) - 2T_{ambient}] + mc_p(1-\theta)(T_2 - T_3) + \frac{1}{2}M_HC_p(T_2 + T_3) =$$
$$[\frac{1}{2}M_HC_p - mc_p\theta - \frac{A_H\Delta t}{2R_{HO}}]T_2' + [\frac{1}{2}M_HC_p + mc_p\theta - \frac{A_H\Delta t}{2R_{HO}}]T_3' \quad (13)$$

Return water pipes modeling

The return water pipes are modeled using the following equation [31]:

$$-\frac{A_c\Delta t}{2R_c}[(1-\theta)(T_4 + T_1) - 2T_{ambient}] + mc_p(1-\theta)(T_4 - T_1) + \frac{1}{2}M_cC_p(T_4 + T_1) =$$
$$[\frac{1}{2}M_cC_p - mc_p\theta - \frac{A_c\Delta t}{2R_c}]T_4' + [\frac{1}{2}M_cC_p + mc_p\theta + \frac{A_H\Delta t}{2R_{HO}}]T_1' \quad (14)$$

Heating equipment modeling

In the present study, thermal behavior of three different heating equipments are investigated such as radiator, fan coil, solar radiative panel presented in the following sections, respectively.

Radiator heating system

Radiators are simply used in water thermal systems with low working temperature. Radiators are efficient heating exchangers that transfers heating energy through convection into their surrounding air. In the present study, the mathematical model for radiators is determined with the use of mass and energy conservation equations in unsteady condition as follows:

$$-\frac{C_2\,\Delta t}{2^n}[(T_3+T_4-2T_a)^n-\theta(T_3+T_4-2T_a)^{n-1}(T_4+T_3)]+mC_p(1-\theta)(T_3-T_4)+\frac{1}{2}M_1C_p(T_4+T_3)=[\frac{1}{2}M_1C_p-mc_p\theta+-\frac{C_2\,\Delta t}{2^n}\theta(T_3+T_4-2T_a)^{n-1}]T_3'+[\frac{1}{2}M_1C_p+mc_p\theta+-\frac{C_2\,\Delta t}{2^n}\theta(T_3+T_4-2T_a)^{n-1}]T_4' \quad (15)$$

where T_a, M_1, C_1 and n are known as temperature of room at t and t+ Δt, water mass inside the radiator, radiator performance coefficient and power coefficient, respectively. Note that we consider n=1.3 for radiators and C_1 coefficient is normally calculated depending on radiator type from experimental tests of catalogs. Heat transfer from a radiator is presented by equation (16).

$$Q_L=-C_1\Delta t(T_L-T_a)^n \quad (16)$$

where heat transfer from radiators, mean water temperature inside radiators are shown with Q_L and T_L, respectively.

Fan coil heating system

Fan coils are generally used in central heating systems working with water. In order to determine fan coil heating load, it is required to utilize dynamic modeling using mass and energy conservation equations as many different commercial software did for fan coil modeling.

$$mC_p(1-\theta)(T_3-T_4)+\frac{1}{2}M_1C_p(T_4+T_3)-\varepsilon C_{min}\Delta t(T_3-T_{air})=[\frac{1}{2}M_1C_p-mC_p\theta]T_3'+[\frac{1}{2}M_1C_p+mC_p\theta]T_4' \quad (17)$$

where space temperature, water mass in fan coil and fan coil efficiency are denoted by T_{air}, M_1 and ε, respectively. The heat loss from fan coil is presented by equation (18).

$$Q_T=\varepsilon C_{min}(T_{h,i}-T_{c,i}) \quad (18)$$

where Q_T, C_{min}, $T_{h,i}$ and $T_{c,i}$ are known as heat transfer from fan coil to the surroundings, minimum value of chilled water, hot fluid temperature (indoor air) and hot fluid temperature (hot water in fan coil), respectively.

Solar radiative panel system

One of the most common ways utilized for heating residential zones is to use heating equipment inside buildings. There are two main types of equipments used for heating buildings known as conventional heating systems such as radiators, fan coils and other HVAC systems and radiant heating systems like radiative panels, which are used for heating residential zones due to their high efficiency and less financial cost instead of HVAC systems.

The solar radiant systems have simple mechanism that is described briefly in this section. Any objects may have noticeable temperature rise without covering or protection to the day sky due to incoming radiative energy from the sun and surroundings. The incoming radiation can be stored in radiative elements throughout a day to provide sufficient energy for heating buildings during cold season. Therefore, it is common to place radiative elements in some locations facing the sunlight to provide enough radiative heating energy for buildings during the day, as it is shown in figure 4.

There are two main types of solar radiative panels used for heating buildings known as covered and uncovered radiative panels. The covered radiative panels are related to real exposed surfaces, where a combination of different heat transfer mechanisms such as conduction, convection and radiation exists and its net heating rate N (W m^{-2}) obeys equation (19) in the steady state condition.

$$N = \iint \square_r(\theta,\lambda)[B_r(\lambda) \quad R_s(\vartheta,\lambda)]\, d\lambda d\Theta \tag{19}$$

where $\square_r(\theta,\lambda)$ is known as radiative emissivity, $B_r(\lambda)$ is defined as the black body spectral radiance Planck function and $R_s(\theta,\lambda)$ is the atmospheric spectral radiance. On the other hand, the main heat transfer mechanism is radiation in the covered radiative panel and the heating rate *N* ($W\ m^{-2}$) is stated by equation (20) in the steady state condition.

$$N = \iint [\frac{\epsilon_c(\theta\lambda)\epsilon_r(\theta,\lambda)}{1-r_r(\theta\lambda)r_r(\theta\lambda)r_r(\theta,\lambda)}][B_r(\lambda) - R_s(\theta,\lambda)]\, d\lambda d\Theta \tag{20}$$

where the spectral and angular transmittance, emittance and reflectance of the cover are denoted by $t_c(\theta,\lambda)$, $\epsilon_r(\theta,\lambda)$ and $r_r(\vartheta,\lambda)$. The radiative panel heating rate is a function of temperature gradient (ΔT_r), which is defined as equation (21).

$$\Delta T_r = T_c - T_r \tag{21}$$

It is noticeable that maximum heating rate is occurred, when the temperature gradient (ΔT_r) is equated to zero and is presented with equation (22).

$$N_{max} = \iint [1 - \epsilon_r(\theta,\lambda)\, d\lambda d\Theta \tag{22}$$

$$\epsilon_s = \frac{\int B_s(\lambda)\epsilon_s(\theta\lambda)}{\int B_a(\lambda)} \tag{23}$$

where ϵ_s is the environment emissivity and B_a is the Planck function corresponding to the absolute ambient T_a in equation (23). The efficiency of a radiative panel is expressed by equation (24):

$$\eta = \frac{N}{N_{max}} = \frac{N}{(1-\epsilon_s)\sigma T_a^4} \tag{24}$$

The other related parameters are commonly chosen depending on thermal comfort situation in buildings. To analyze heating equilibrium equation of indoor air, one requires to determine heat generation term (Q_{gen}) from the external

heat source, which exactly equals the heating rate (N) and can be respectively calculated from equations (19) and (20) for the covered and uncovered radiative panels.

Direct modeling solution algorithm

All different governing equations of building thermal analysis have to be solved to achieve temperature field and heating loads using direct modeling simulation, which is able to correlate these governing equations with each other and solve them simultaneously inside the building. The correlation consists of following points:

- The indoor air convection heat transfer equation is used as boundary condition for unsteady heat conduction equation.
- Wall surface temperature appears in the indoor air convection heat transfer equation.
- Internal/external radiative flux is utilized as boundary condition for unsteady heat conduction equation and the furniture convection heat transfer equation.

It is difficult to solve these equations simultaneously because of non linear correlation between the governing equations. To solve these governing equations, finite-volume numerical scheme is implemented to change equation (8) into equation (25), which is known as direct modeling equation.

$$T^{n+1}_{air} = T^{n}_{air} + \frac{1}{m_{air} c_{p,\,air}} \left[\sum_i h_i A_i \left(T^{n+1}_{s,i} - T^{n+1}_{air}\right) + h_{fur} A_{fur} \left(T^{n+1}_{fur} - T^{n+1}_{air}\right) + Q^{n+1}_{gen}\right] \quad (25)$$

To solve the direct modeling equation, direct modeling solution algorithm is to be implemented, which is shown in figure 5 that consists of several following steps:

- Enter initial conditions, wall properties and climate weather into the solution algorithm
- Solve the internal and external radiation equations
- Solve unsteady heat conduction equation
- Solve indoor and furniture convection equations simultaneously
- Achieve the temperature field as the output data of direct modeling solution algorithm through an iterative process

The stopping criterion of direct modeling solution algorithm is when the difference between two iterations is less than threshold limit. To compute energy consumption for each climate inside the sample building, it is necessary to enter the temperature field calculated from direct modeling solution algorithm with climate weather and building properties into the building energy simulation algorithm.

Building energy simulation

The aim of energy simulation is to correlate load modeling (space load) with the heating equipment load, which consists of all kinds of energy used by heating equipment such as electrical energy for pumps and electric fan or heating energy for boilers.There are two major methods utilized for energy simulation regarding building thermal analysis in heat transfer science. As the first method, energy simulation is implemented using steady-state simulation, which is commonly utilized for sizing HVAC systems using indoor sample data and outdoor conditions of buildings, where high heating capacity, low solar absorptivity and constant indoor temperature are the characteristics of the building. However, the results of steady-state simulation are not scientifically worth enough to be used in building load calculation, because the steady-state simulation method does not consider several heating loads made by indoor staffs, lightening load and mass energy storage; though they significantly affect energy consumption in buildings. As the second method, energy simulation is implemented using dynamic simulation approach inside buildings. The purpose of dynamic simulation is to augment the preciseness in building energy simulation. The dynamic simulation attempts to determine several thermo-physical parameter changes with time (hr)

such as conductivity coefficient of walls, solar radiation on walls and windows and heating/cooling load inside residential zones. An illustrative example of dynamic simulation is energy simulation presented by commercial software available in the market. Using these commercial software leads to simulate energy consumption in buildings with the use of building simulation, heating equipment and climate weather condition. In the present study, a dynamic simulation is implemented in order to present energy simulation inside buildings. After modeling each elements of building components, it is necessary to solve direct heating load modeling equations and heating equipment equations simultaneously through an iterative procedure. In each time step of the iterative procedure, the temperature vector of each point is calculated. After calculating temperature vector of heating system and heat loss from equipment, it is essential to use building energy simulation algorithm in order to couple heating load modeling and heating equipment modeling to analyze thermal behavior of the building.

Case study

The case study consists of a building equipped with different heating systems such as radiators, fan coils and solar radiative panels is investigated in the present study, which is shown in figure 7. As it can be seen in figure 7 , the sample building has two floors with the total area of 240 (m^2). According to this figure, the lightening of the building is from two northern windows and 80% of the southern door are from glass. In this sample building, walls are made of different materials. All external walls are made from brick covered with stone with the approximate thickness of 24 centimeters, while all internal walls are made from brick covered with plaster with the approximate thickness of 12 centimeters. The southern windows are from glass with metal Frame and its thickness is approximately 3 millimeters.

The floor and roof are tiled and asphalted, respectively. According to table 1 , general information about structure layers of the sample building are reported for internal and external walls and the ceiling of the floor. According to table 2 , additional information about the dimension of northern windows and door is provided for the sample building. The general information of the building structure is presented in table 3. The results of direct modeling simulation and inverse analysis of the sample building are presented in the following sections.

RESULTS

In the present study, a model consists of a building equipped with different heating systems such as radiators, fan coils and solar radiative panels is investigated using CFD simulation. In order to simulate thermal analysis of building components, it is necessary to follow several steps. As the first step, it is required to define a direct model that is capable of modeling all the building components using some mathematical governing equations. To solve these governing equations, finite-volume numerical scheme is implemented to analyze thermal behavior of building components inside the domain. The results of direct modeling are temperature field using direct modeling solution algorithm at the nodal points inside the computational domain. Initial condition, climate weather and building properties are entered to the direct modeling solution algorithm as input data. These parameters are initially utilized to analyze the internal and external radiation equations in order to calculate internal/external radiative flux of walls inside rooms. The solution of these equations are utilized as boundary condition for unsteady heat conduction equation to determine heating energy flux from walls, which is presented by equation (1). Then, convection heat transfer equations of indoor air and furniture are simultaneously solved for each room to solve building heating equilibrium equation, which is presented by equation (8). The solution of these previous equations is used as initial guess for the direct modeling equation to calculate temperature profile, which is expressed by equation (25). Through an iterativeprocedure, the temperature profile is finally converged to the solution inside the domain. Note that the temperature profile illustrates the results of direct modeling simulation as space- discretized data inside the computational domain. In order to calculate heating energy consumption, it is impossible to use space-

discretized temperature data of direct modeling. Thus, it is required to use bulk model to determine the bulk temperature of each time step inside each room of the building.

The bulk model is able to substitute the space-discretized temperature data of numerical code with an average temperature value inside each room in the building, which is known as bulk temperature of each room. In order to determine building energy consumption, it is required to implement building energy simulation algorithm. In the present study, the building energy simulation algorithm is implemented to calculate energy use of the sample building located in Tehran during 24 hours. Note that all information regarding initial conditions and weather condition including outdoor temperature and solar radiation of Tehran, which are determined from Iran meteorological organization in January. The results of heating load per hour can be gathered inside a diagram for each time step to obtain the heating load changes versus time during 24 hours in the sample building for each heating system, which is illustrated in figure 8. According to figure 8, it can be seen that the heating load results of solar radiative panel are less than those of radiator and fan coil inside the building.

To verify the results of numerical developed code, we present the results of numerical simulation by commercial software such as Carrier and Energy-Plus as it is shown in figure 9. According to figure 9, there is a small difference between the results of Carrier and Energy-Plus due to steady-state nature of these commercial software analyses. According to this figure, energy consumption has sinusoidal behavior throughout the day and the maximum heating load is taking place at night. The results of energy consumption are presented for each of these heating equipments in table 4. According to table 4, there is a good agreement between the results of numerical code, Carrier and Energy-Plus software, which means that numerical code can accurately and precisely estimate thermo-physical parameters of the building such as heating loads and temperature field inside the domain. Therefore, the direct modeling simulation and building energy simulation algorithm can be used to report the results of building thermo-physical parameters such as temperature profile and heating loads, which can be defined as a new approach in analyzing energy consumption in building design, because it allows HVAC engineers to calculate heating loads and energy consumption of buildings more precisely, which leads to reduce the financial cost of building design and is scientifically significant.

DISCUSSIONS

In the present study, we simulate thermal analysis of a building equipped with HVAC systems such as radiators and fan coils and solar radiant systems using a dynamic CFD simulation code. The results of heating loads and energy consumption are presented through different figures and tables in the previous sections. The results of energy consumption of the sample building are reported for six different climates in Iran. The results of energy consumption of these three different HVAC and solar heating systems are presented in table 5. According to table 5, the amount of radiator energy consumption is greater than those of fan coil and solar radiative panel. As it can be seen in table 5, it is noticeable that the most amount of energy use is for Tabriz (climate 3), which is known for its cold climate and the least amount of energy use is for Ahwaz (climate 6), which is a definite characteristic of warm climates. It is remarkable that several climates have similar energy consumption. For instance, this takes place in some climates such as Isfahan (climate 2), Tehran (climate 1) and Shiraz (climate 4), because these cities have fairly same winter temperature. It is noticeable that the use of solar panels can directly decrease considerable energy use rate in some climates such as Tabriz (climate 3). Note that there is no difference using radiator or fan coil heating systems in the climates, where there is no considerable temperature gradient between day and night temperature such as Tehran (climate 1) and Isfahan (climate 2). In order to observe energy use, the results of energy consumption are illustrated in figure 10.The results of relative energy saving potential of these three different heating systems are presented in table 6. The relative energy saving potential is considerable in some climates such as Tabriz (climate 3) and Tehran (climate 2). It is remarkable that the greatest amount of energy saving potential is occurred in Tabriz (climate 3) and Isfahan (climate 2), because Tabriz (climate 3) has very cold and long winter during the year and

fairly cold but not long winter is the main characteristic of Isfahan (climate2) throughout the year. On the other hand, the least amount of relative energy saving potential is for Ahwaz (climate 6) and Khorasan (climate 5). It is evident that Ahwaz (climate 6) has considerable relative energy saving potential in comparison with Khorasan (climate 5) because of short dry winter time of Ahwaz (climate 6) with moderate temperature. As it can be seen in table 6, the energy saving potential of Shiraz (climate 4) and Isfahan (climate 2) have relatively same values due to the fact that there is similar insulation commonly used in buildings in these cities. Therefore, building insulation type plays a significant role to determine relative energy saving potential in each climate. As it can be seen in this table, the amount of relative energy saving potential of solar panels are greater than those of HVAC heating systems, which indicates that solar radiative panels can achieve thermal comfort inside buildings with the least possible energy use. The results of relative energy saving potential of these different heating equipments are illustrated in figure 11. The results of absolute energy saving potential values are reported in table 7. According to table 7, there is considerable absolute energy consumption saving using radiative panel, which is entirely evident in some climates such as Tehran (climate 1), Isfahan (climate 2), Tabriz (climate 3) and Shiraz (climate 4). As it can be seen in this table, there is no difference between using radiator or fan coil HVAC systems in some climates in Iran such as Tehran (climate 1), Isfahan (climate 2) and Shiraz (climate 4), because there is a small difference between the results of radiator and fan coil absolute energy saving potential as it is shown in figure 12. By comparing the results of energy consumption in different climates, it is evident that the use of solar radiant systems is an appropriate heating equipment for several climates with cold dry winters during the year such as Tabriz (climate 3) and Isfahan (climate 2). The use of HVAC systems like radiator and fan coil heating systems can be a good choice in some climates with moderate winter temperature such as Khorasan (climate 5) and Ahwaz (climate 6).As it can be seen in the tables, it is applicable to change conventional HAVC systems with solar radiant systems to improve thermal comfort inside residential buildings. On the other hand, this heating pattern is not applicable in some climates in Iran such as Ahwaz (climate 6) and Khorasan (climate 5) on account of their moderate winter temperature, because the radiative panel works efficiently, where the climate is comparatively cold and dry during the cold season. Therefore, it seems suitable to select HAVC systems as heating equipment in these climates of Iran. The use of solar radiant systems can work as an efficient heating equipment in many countries around the world such as Iran. However, there are several problems associated with the use of solar radiant systems in Iran. The cost of its maintenance and installation makes it hard to choose radiative panel as the current heating system in Iran but the use of radiant systems in some countries like Iran can be a good choice, because solar radiative panel heating system is not commonly utilized as heating equipment of buildings in different climates in Iran. Therefore, it seems a good choice to use solar radiative panel for heating buildings to decrease heating energy use in cold seasons for most climates in Iran.

CONCLUSION

In the present study, thermal analysis of a model consists of a building has been investigated with the use of CFD simulation (direct energy modeling). The thermal analysis of the building has been investigated with different HVAC systems such as radiator and fan coil and solar radiative panel heating systems. In order to present building thermal analysis, a new direct model has been initially defined to simulate thermal behavior of building components with the use of dynamic simulation. With the use of heating load modeling algorithm, several thermo-physical parameters have been calculated inside the domain such as heating load and temperature field. The results of temperature field have been entered into building energy simulation algorithm to determine energy consumption rate for each heating system inside the building. To verify the numerical simulation, the results of CFD developed code are compared to those of Carrier and Energy-Plus commercial software, which indicates the CFD developed code has simulated thermal analysis of building components with excellent preciseness. Therefore, one of the special feature of the present study is to analyze thermal behavior and energy consumption of buildings with the use of novel CFD simulation with proper accuracy. The other special feature of the recent research is to present a comparative study of energy consumption rate for these different heating systems in six different climates of Iran. The results have shown that using radiative panel as the building heating equipment can be a suitable choice to decrease the energy consumption in Iran. The Use of solar radiative panel will result in considerable energy saving almost in most of

climates especially with cold and dry winter. However, it is not appropriate to utilize solar radiant systems in some climates with moderate winter temperature due to lack of sufficiency and their intense maintenance and installation cost. In this case, it is firmly suggested to use HVAC systems such as radiators and fan coils instead of solar radiant systems. From energy point of view, It seems reasonable to change the conventional heating systems such as radiators, fan coils and other HVAC systems with the solar radiant heating equipments, which leads to have energy saving in buildings. In conclusion, it is essential to remind the necessity of the concept of energy saving in residential buildings for future, which is possible by using proper heating systems and increasing the accuracy and preciseness of building energy modeling.

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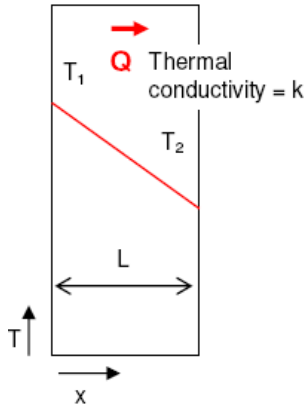

Figure 1. Heat conduction through walls.

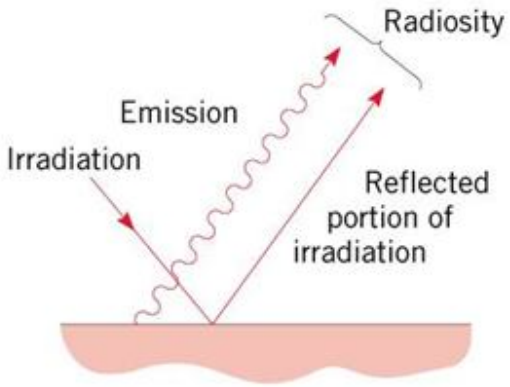

Figure 2 . Radiation from the surface of a body

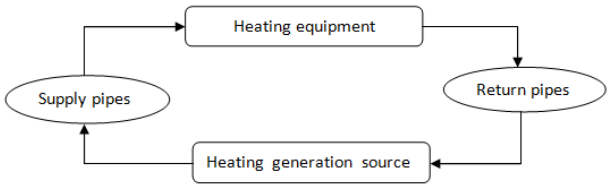

Figure 3. The main elements of HVAC cycle

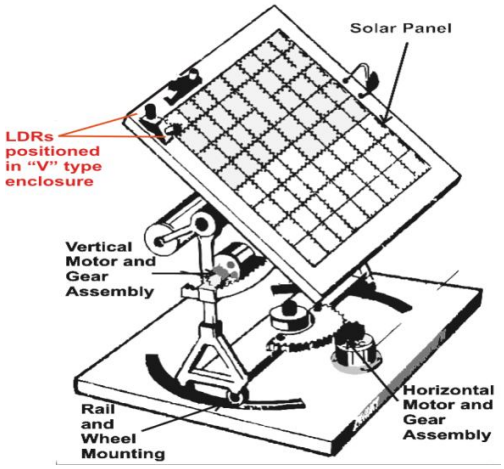

Figure 4.The solar radiative panel sketch

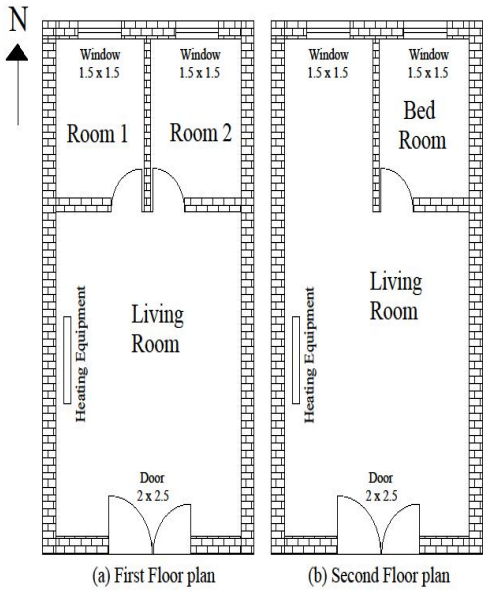

Figure 5. Plan of a building equipped with different heating systems

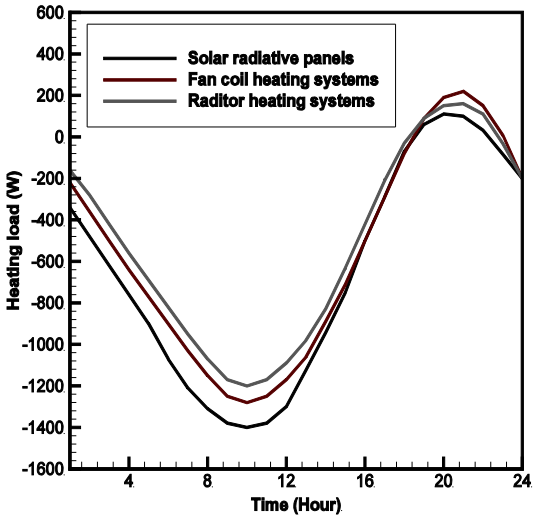

Figure 6. Heating load comparison between radiator, fan coil and solar radiant heating systems

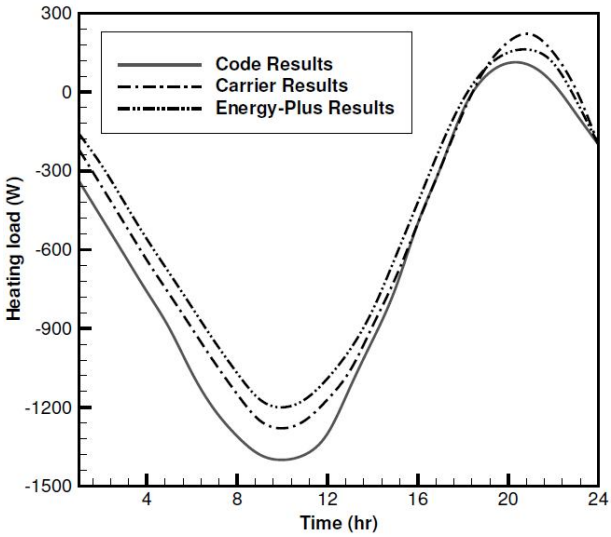

Figure 7.Heating load simulation with code, carrier and energy-plus results

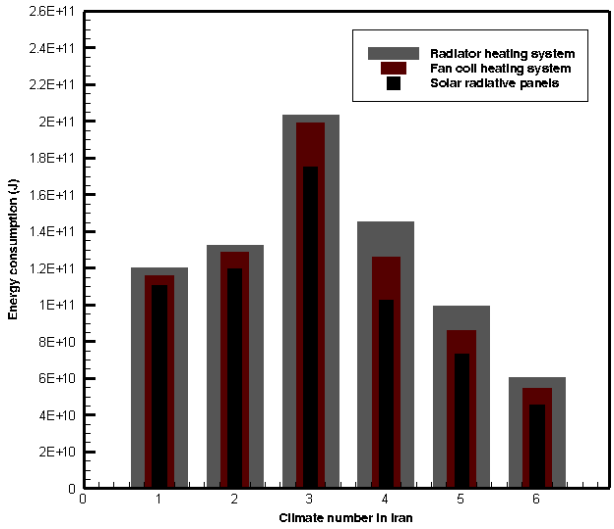

Figure 8. Energy consumption results for the sample building in different climates of Iran

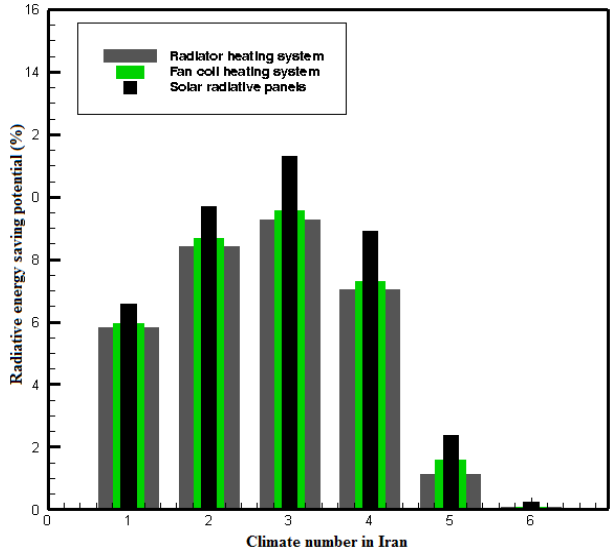

Figure9. Relative energy saving potential results for the sample building in different climates of Iran

Table 1. Information of structure layers of sample building

Layers	Thickness (mm)	Thermal resistance $(m^2 K W^{-1})$
Internal walls	**120**	**0.44**
External walls	**240**	**0.58**
Ceiling of the floor	**260**	**0.71**

Table 2. Dimension of windows and doors of sample building

Type	Northern wall	Western wall	Eastern wall	Southern wall
Windows	1.5×1.5	-	-	-
Door	-	-	-	2×2.5

Table 3.General information of the building structure

Structure	Layer numbers	Thickness (mm)	cp ($J\,kg^{-1}K^{-1}$)	Density ($kg\,m^{-3}$)	Solar absorptivity
Northern and southern walls	3	15 100 100	1090 840 920	801 609 2002	0.9
Eastern and western walls	3	15 150 100	1090 840 920	801 609 2002	0.9

Table 4.Maximum heating load simulation results during 24 hours

Quantity	Numerical code	Energy- plus	Carrier
Heating load (W)	1400	1224	1280

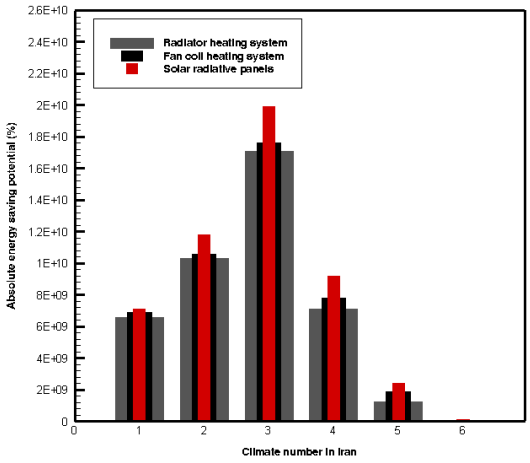

Figure 10. Relative energy saving potential results for the sample building in different climates of Iran

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RESEARCH ARTICLE

Correspondence Analysis of the Global Epidemiology of Cutaneous and Visceral Leishmaniasis

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ABSTRACT

Cutaneous leishmaniasis is mostly prevalent in the western and central Asia, North Africa, Southeastern Europe, Central and South America while visceral leishmaniasis is most prevalent in Central, South and Western Asia, the Mediterranean countries, East Africa, Southeastern Europe and South America. Result from the correspondence analysis showed that the number of reported cases of cutaneous leishmaniasis is increasing moderately while visceral leishmaniasis is increasing slightly. The plots showed that countries that are clustered together have similar trend while isolated countries have irregular trend.Correspondence analysis has helped to reveal many hidden patterns of the data and the models are significant even with though the model was able to explain small amount of variation of the data. The research concluded with some suggested policy statements and recommendation.

Keywords: Leishmaniasis, cutaneous, visceral, epidemiology, correspondence analysis, risk factors

INTRODUCTION

Disease Profile: Leishmaniasis which can be mainly classified into cutaneous, mucocutaneous or visceral, is a disease caused by protozoan parasite of the genus *Leishmania* (which are of over 20 species), and spread by the bite of certain species of sandflies (W.H.O., 2015). Also contained in the W.H.O. (2015) is some basic information about leishmaniasis which states that Visceral leishmaniasis (VL) is the most serious form of the disease and is often known as *Kala-azar* while Cutaneous leishmaniasis (CL) is the most common. Mucocutaneous leishmaniasis (ML) can manifest in form of ulcers of the mouth, nose and the throat, cutaneous leishmaniasis can cause severe ulcers, skin

lesions and disability to the host, while visceral leishmaniasis has high fatality rate if left untreated and can manifest as fever, enlargement of the spleen and liver, anaemia, etc. (Barrett & Croft, 2012; W.H.O., 2015; Wikipedia, 2015).
The disease risk factors which have been on the increase include: poverty, illiteracy, malnutrition, rapid urbanization, deforestation, irrigation, construction of dams (Desjeux, 2001a, 2001b; W.H.O., 2015; Wikipedia, 2015). Suggested measures to reduce the exposure include sleeping with treated nets, spraying insecticides, and early diagnosis and treatment (W. H. O., 2015).

Epidemiology

According to the World Health Organization fact file on leishmaniasis (2015).
a). An estimated 1.3 million cases of leishmaniasis and between 20,000 to 30,000 deaths occur annually.
b). 90% of new cases of visceral leishmaniasis occurs in 6 countries; Bangladesh, Brazil, Ethiopia, India, South Sudan and Sudan.c). 95% of new cases of cutaneous leishmaniasis occurs in the Americas, Mediterranean, the Middle East and Central Asia. The most endemic countries are Afghanistan, Algeria, Brazil, Colombia, Iran and Syria.

Yamey (2002) listed leishmaniasis as one of the neglected diseases. The disease is mainly endemic in tropical and subtropical regions. Many researchers have written about the epidemiology, outbreak, prevalence, monitoring, control, trend, distribution, management and treatment of leishmaniasis. Some selected epidemiologic chronologies of leishmaniasis are listed to highlight the prevalence and the review of the literature over time. The disease was reported in Greece (Malamos, 1946)**,**a review of the outbreak and prevalence of leishmaniasis in Africa (Kirk, 1956).The epidemiology of Leishmaniasis havebeen studied based on research findings of researchers at/from/in or on East Africa (Southgate, 1964), Sudan (Cahill, 1964), French Guiana (Pajut et al, 1982), Jordan (Schlein & Gunders, 1982), Nicaragua (Garfield, Frieden &Vermund, 1987), Syria (Ashford et al, 1993), Algeria (Harrat et al, 1995), Texas in the US (McHugh, Melby & LaFon, 1996), Turkey (Ok et al, 2002), West Bank (Abdeen et al, 2002), Burkina Faso (Guiguemdé et al, 2003), Iraq (Gani, Kadhum Hassan & Jassim, 2010), Spain (Gil-Prieto et al, 2011), Middle East (Salam, Al-Shaqha & Azzi, 2014) The Cutaneous leishmaniasis prevalence, outbreak and epidemiology have appear in many literature such as: the republic of Panama (Calero & Johnson, 1953), South Australia (Sanderson, 1961), Iran (Seyedi-Rashti & Nadim, 1967), Ethiopia (Lemma et al, 1969), Sudan (Abdalla et al, 1973), Afghanistan (Nadim & Rostami, 1974), Greece (Stratigos et al, 1980), Guyana (Low-Chee, Rose & Ridley, 1983), Saudi Arabia (Al-Gindan, Abdul-Aziz & Kubba, 1984), Egypt (Fryauff et al, 1993), Northeast Pakistan (Rowland et al, 1999),Venezuela (Rodriguez et al, 2002), Northern Tunisia (Belhadj et al, 2003), Morocco (Ramaoui, Guernaoui & Boumezzough, 2008), Iraq (AlSamarai & AlObaidi, 2009), Iran (Karami, Doudi & Setorki, 2013), Sri Lanka (Sandanayaka et al, 2014).Visceral leishmaniasis prevalence, outbreak and epidemiology have appear in many literature such as: the Mediterranean region (Pampiglione et al, 1974), Kenya (Ho et al, 1982),Italy (Gradoni et al, 1983), Ethiopia (Ayele & Ali, 1984),Colombia (Corredor et al, 1989), Northeast Brazil (Evans et al, 1992), Southern Sudan (Seaman, Mercer & Sondrop, 1996),France (Minodier et al, 1998), India (Bora, 1999), Malta (Grech et al, 2000), India (Singh et al, 2006), Bangladesh (Bern et al, 2007), Nepal (Bhattarai et al, 2010), Brazil (Marcondes & Rossi, 2014), Georgia (Babuadze et al, 2014), China (Zhao et al, 2015).

Rab, Frame and Evans (1995) observed that dogs play an important role in the epidemiology of visceral leishmaniasis. See Mohebali et al (2001) for the seroepidemiological study of visceral leishmaniasis among humans and animals. Leishmaniasis can be co-infected with HIV (Desjeux &Alvar, 2003)**.** Alvar et al (2012) reviewed the global incidence, prevalence and epidemiology of cutaneous and visceral leihmaniasis while Ready (2014) wrote extensively on the epidemiology of visceral leishmaniasis.

METHODOLOGY

Statistical tools are indispensable in the understanding of epidemiology. An exploratory or inferential analysis of epidemiological or seroepidemiological data is used for the proper understanding of the causation, profiling,

prevalence, outbreak, isolation, monitoring and control of identified diseases. Statistical methods have been applied in the study of the epidemiology of diseases including cutaneous and visceral leishmaniasis. Some of the selected methods include: spatial analysis of CL and VL (Franke et al, 2002), spatial analysis for VL (Werneck et al, 2002; Correa Antonialli, et al, 2007), generalized linear spatial models in the epidemiology of CL (Ben-Ahmed, Bouratbine & El-Aroui, 2010), spatial distribution and cluster analysis of leishmaniasis outbreak of CL and VL (Barroso et al, 2015), spatial analysis for identification of priority areas (Barbosa et al, 2014), spectral analysis of epidemiological data (Cazelles et al, 2007), Muti-level modeling of VL (Werneck et al, 2007), Bayesian Geostatistical modeling (Karagiannis et al, 2013), prediction of high risk areas using remote sensing (Almeida & Werneck, 2014).
This research is concerned with the use of statistical method called correspondence analysis to explore the global epidemiology of cutaneous and visceral leishmaniasis. The reasons for the use of correspondence analysis for epidemiological data can be seen in the works of Sourial et al (2010) and Zalewska et al (2013). Multiple correspondence analysis (MCA) has been applied in the analysis of epidemiological data (Van der Burg, De Leeuw & Verdegaal, 1988). Loslever & Ranaivosoa (1993) applied multiple correspondence factor analysis to biomechanical and epidemiological data. Leibovici, Curtis & Ritchi (1995) applied factorial correspondence analysis to disability data obtained from epidemiological survey. Verzini et al (1995) advocated the use of multiple correspondence factorial analysis to detect risk groups in epidemiological research. Calavas et al (1998) realized a typology of clinical udder disease of nursing ewe flocks by using MCA and Ascending Clustering. Correspondence Factor analysis was applied to investigate the relationship between the age and gender of patients, and changes in their urinary stone compositions (Daudon et al, 2004). See (Rennie & Roberts, 2009) for the application of MCA to epidemiological study of tuberculosis. MCA was also to explore dietary patterns and their links to urinary tract tumors in a epidemiology study (Andreatta et al, 2010). Van Specht et al (2014) analyzed epidemiological data using multiple correspondences and Cluster analysis. MCA was used as a statistical method to establish typologies of epidemiological data of suicide prevalence (Ortega et al, 2014). Hendry et al, (2014) applied subset correspondence analysis to epidemiological data.

Details of the theory and applications of correspondence analysis can be found in Greenacre (1984), Clausen (1988), Benzecri (1992), Doey & Kurta (2011). The datawas retrieved from the World Health Organization repository at http://apps.who.int/gho/data/node.main.NTDLEISH?lang=en. The collected data was organized as the number of reported cases of the both types of the disease.

Reasons for using correspondence analysis

Not all the countries were selected for analysis; this is to a control against violating the strict conditions of correspondence analysis. See Doey & Kurta (2011) for details. For this reason, only 26 countries were selected for analysis for cutaneous leishmaniasis while 24 countries were selected for analysis for visceral leishmaniasis. This can be classified as subset correspondence analysis. The number of reported cases is discrete and the population is dichotomous; it is either that a case is reported or not. This can be analyzed as a yes or no questionnaire where the researcher may choose to analyze only yes or no separately. Even when the number of cases is continuous, the data may be discretized by classification. The correspondence model uses chi-square as the measure of distance which takes care of non-discretization. Correspondence analysis measures the trend taking into consideration of the variations of different dimensions, using only the descriptive to explain the trend may yield misleading results. Correspondence analysis is applied to this research to make sense out of the data that are big, confusing and vague.

RESULTS

We are not looking at the relationship between the countries and the years, but a graphical interpretation of the trend and the general prevalence among the countries. For that reason, biplots are excluded from the analysis.

Epidemiology of cutaneous leishmaniasis of the selected countries.

The selected countries are Afghanistan AFG, Algeria ALG, Argentina ARG, Azerbaijan AZE, Brazil BRA, Colombia COL, Ecuador ECU, Guatemala GUA, Guyana GUY, Honduras HON, Iran (Islamic Republic) IRN, Iraq IRQ, Jordon JOR, Mexico MEX, Morocco MOR, Nicaragua NIC, Pakistan PAK, Panama PAN, Paraguay PAR, Peru PER, Saudi Arabia SAU, Syria SYR, Tunisia TUN, Uzbekistan UZB and Yemen YEM. Analysis from **table 1** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 196919.22. The total variance explained is 12%. Dimensions 3 to 8 are almost insignificant because they account for little of the total inertia explained. The trend of the cutaneous leishmaniasis has been on a steady increase for the selected countries as shown in **figure1.**

The countries grouped together have a similar trend; for example looking at the W.H.O. data on cutaneous leishmaniasis, we discover that the number of reported cases of the disease is decreasing in the four countries grouped together in **Plot 1**; those countries are Algeria, Guatemala, Pakistan and Tunisia.

Epidemiology of visceral leishmaniasis of the selected countries.

The selected countries are Algeria ALG, Azerbaijan AZE, Bangladesh BAN, Brazil BRA, China CHI, Colombia COL, Ethiopia ETH, Greece GRE, India IND, Iran (Islamic Republic) IRN, Iraq IRQ, Italy ITA, Morocco MOR, Nepal NEP, Paraguay PAR, Portugal POR, Saudi Arabia SAU, South Sudan SSU, Sudan SUD, Syria SYR, Tajikistan TAJ, Tunisia TUN, Turkey TUR and Uzbekistan UZB.

The countries grouped together have a similar trend; for example looking at the W.H.O. data on visceral leishmaniasis, we discover that the number of reported cases of the disease is decreasing steadily in the two countries grouped together in **Plot 2**; those countries are Bangladesh and Colombia. The isolated South Sudan is because the data does not follow a particular trend.

Epidemiology of cutaneous leishmaniasis in the continents

All the 26 selected countries are grouped into 5 continents namely Africa AFR, Asia ASI, Europe EUR, North and Central America NCA and South America SAM.

Analysis from **table 3** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 196919.22. The total variance explained is 4%. Dimensions 3 and 4 are almost insignificant because they account for little of the total inertia explained.

The data of Africa does not follow a particular trend while the number of reported cases is on decline in North and Central America and South America. The number of reported cases of cutaneous leishmaniasis is on the rise in Asia and Europe as shown in **Plot 3.**

Epidemiology of visceral leishmaniasis in the continents

All the 24 selected countries are grouped into 4 continents namely Africa AFR, Asia ASI, Europe EUR and South America SAM.

Analysis from **table 4** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 30669.72. The total variance explained is 6.6%. Dimension 3 is insignificant because they account for little of the total inertia explained. The number of reported cases of VL is decreasing in Europe and South America. There is no particular trend in Africa and Asia as shown in **Plot 4.**

The epidemiological study of the 6 most endemic countries of cutaneous leishmaniasis

The 6 most endemic countries are Afghanistan AFG, Algeria ALG, Brazil BRA, Colombia COL, Iran (Islamic Republic) IRN and Syria SYR.

The number of reported cases of CL is decreasing steadily in Colombia and Brazil and increasing rapidly in Syria while decreasing rapidly in Algeria as shown in **Plot 5.**

The epidemiological study of the 6 most endemic countries of visceral leishmaniasis

The 6 most endemic countries are Bangladesh BAN, Brazil BRA, Ethiopia ETH, India IND, South Sudan SSU and Sudan SUD.

The number of reported cases of VL is decreasing slightly in Brazil and India and rapidly in Bangladesh while South Sudan does not follow a particular trend as shown in **Plot 6.**

Some selected countries affected by both cases of leishmaniasis

The selected countries that reported both cases of leishmaniasis are Algeria, Azerbaijan, Brazil, Colombia, Iran, Iraq, Morocco, Paraguay, Saudi Arabia, Syria, Tunisia, Turkey and Uzbekistan.

DISCUSSION

The plots 1 to 6 are arranged in such a way that countries that are grouped together have similar trend; the trend may be constant, increasing rapidly, moderately or slightly or decreasing rapidly, moderately or slightly. Countries that are isolated in the plots have an irregular trend. The number of reported cases of CL is increasing while the number of reported cases of VL is increasing slightly after some years of decline and the same result was obtained when the countries were collapsed into 4 continents. The trend of the cutaneous leishmaniasis has been on a steady decrease for the continents of the selected countries but this result can be discarded since the total variance explained from the model is 4% compared with 12% when the data was analyzed from the countries without grouping them into the continents.The grouping had reduced the significant of the model. The reported cases of CL are also increasing in the 6 most endemic countries while the reported cases of VL are increasing slightly in the 6 most endemic countries. The trend is also on the decline for some countries that have reported both CL and VL.

Policy Statements and Recommendations

Efforts must be intensified to reduce the risk factors that act as breeding grounds for the diseases. The following statements can serve as policy and can serve as a guide to the policy makers of the most endemic countries. **Bangladesh:** Efforts should be intensify in providing quality education, reducing extreme poverty and distribution of treated nets to the remote rural areas. **Brazil:** Measures should be in place to reduce deforestation and illegal logging in the Amazon. The rapid urbanization and construction of more dams to meet the power needs of the rapidly growing economy is expected to increase the risk factors of both CL and VL in the country. **Ethiopia:** Draught, poverty, illiteracy, inadequate health facilities and increased irrigation because of draught are some of the factors that can determine the future trend of VL in the country. **India:** Rapid urbanization and increased irrigation to meet the demands of the increasing population are some of the major factors that may determine the trend of VL in the country **South Sudan and Sudan:** Poverty, illiteracy, lack of adequate health facilities as a result of political instability are the main risk factors. Also the volatile Darfur region is being plagued by draught, extreme deforestation and desertification. Internally displaced camps are also vulnerable

to all sorts of diseases, in some case, people sleep outside their tents without using treated nets. Massive irrigation at the Nile is also a major risk factor that can help in the spread of VL in the countries. Actual information on the actual prevalence may not be possible because of the ongoing civil war and political instability and researchers may use estimates which may not reflect the true picture of the prevalence of the disease. **Afghanistan:** Poverty, illiteracy, insecurity and inadequate health facilities as a result of extremism and political instability are major risk factors. Also refugee camps are also vulnerable to diseases because of bad sanitary conditions, overcrowding and dearth of qualified medical personnel.**Algeria:** Illiteracy, deforestation, insecurity, extreme poverty and malnutrition have to be tackled in order to reduce the trend. **Colombia:** Years of civil war have affected the medical facilities and lack of infrastructure in the remote villages cut off by the civil war is also a major risk factor. Also deforestation caused by pulling down trees as a source of fuel is a major risk factor here. **Iran:** Years of isolation and international sanctions have resulted to inadequate medical facilities and illiteracy, poverty and natural disasters have also contributed to the increased number of reported cases**Syria:** CL is expected to rise drastically if the crisis in the country is not controlled. Destruction of natural habitat, infrastructure, medical facilities and insecurity are the key risk factors. Also camps for displaced persons and refugees are also vulnerable because of insecurity, lack of treated nets, overcrowding, poor sanitary conditions and dearth of medical personnel. Also the countries hosting refugees from Syria are expected to have an increase of the reported cases

CONCLUSION

Correspondence analysis is used to explore the epidemiology of Cutaneous and visceral leishmaniasis. Different trends and prevalence of the disease were shown and some policy statements were made as recommendations on possible ways to reduce the number of reported cases of the disease.

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Table 1. Summary table for CL of the selected countries.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulat-ive	Standard Deviation	Correlation 2
1	.258	.067			.552	.552	.001	.158
2	.181	.033			.269	.821	.001	
3	.096	.009			.076	.897		
4	.071	.005			.041	.938		
5	.059	.004			.029	.967		
6	.046	.002			.017	.984		
7	.035	.001			.010	.995		
8	.025	.001			.005	1.000		
Total		.121	196919.122	.000[a]	1.000	1.000		
a. 200 degrees of freedom								

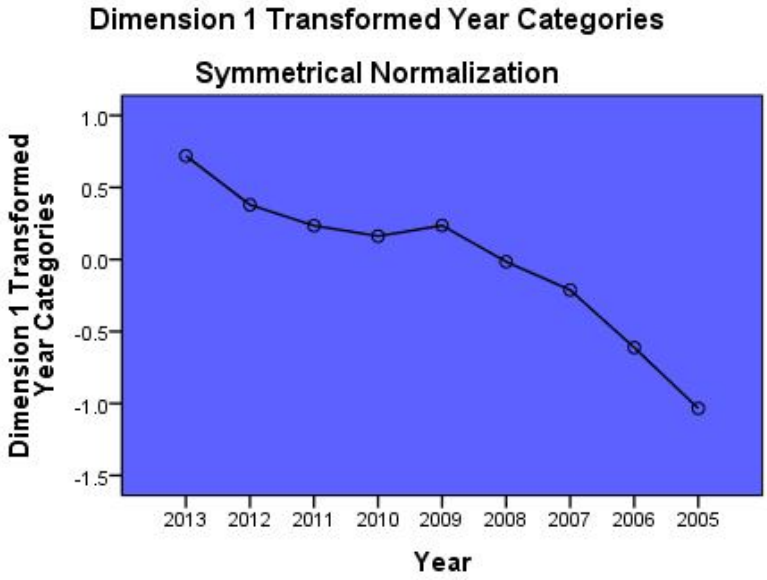
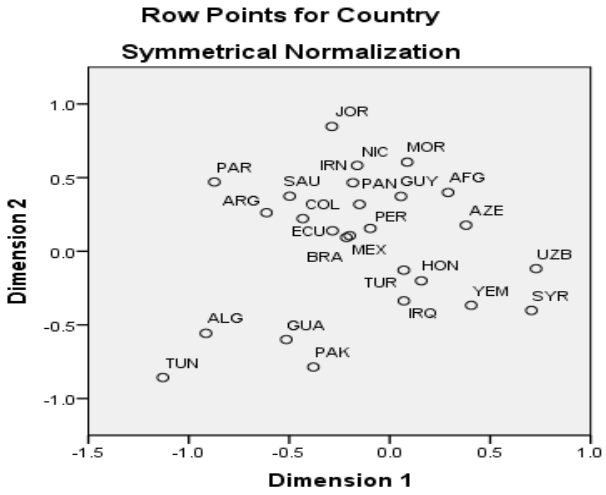


Figure 1. The trend of CL of the selected countries.

Figure 1.The trend of the cutaneous leishmaniasis has been on a steady increase for the selected countries



Plot 1 A plot of the CL of the selected countries.

Table 2 Summary table for VL of the selected countries.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.291	.085			.740	.740	.001	.087
2	.127	.016			.140	.880	.001	
3	.090	.008			.072	.952		
4	.056	.003			.028	.979		
5	.038	.001			.013	.992		
6	.025	.001			.005	.997		
7	.014	.000			.002	.999		
8	.009	.000			.001	1.000		
Total		.114	53508.515	.000[a]	1.000	1.000		
a. 184 degrees of freedom								
Analysis from **table 2** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 53508.5. The total variance explained is 11%. Dimensions 3 to 8 are almost insignificant because they account for little of the total inertia explained.								

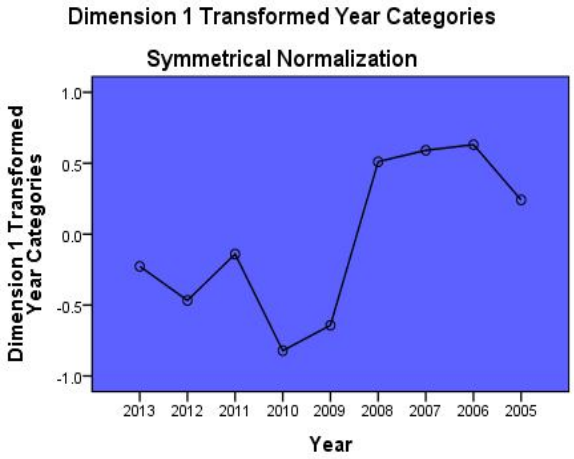
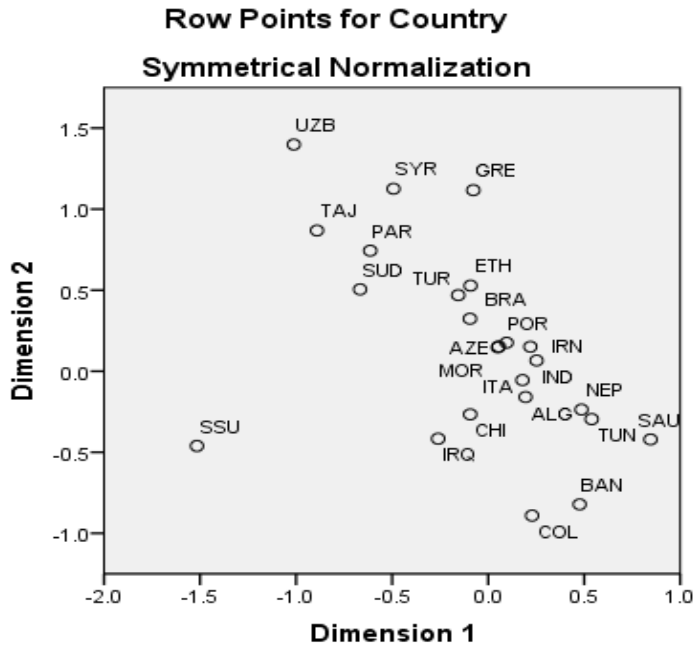


Figure 2 The trend of VL of the selected countries.

Figure 2.The trend of the visceral leishmaniasis has been on a slight increase after some years of sharp decrease for the selected countries.



Plot 2 A plot of the VL of the selected countries.

Table 3 Summary table of CL of the continents.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.195	.038			.859	.859	.001	.090
2	.069	.005			.109	.968	.001	
3	.034	.001			.025	.993		
4	.017	.000			.007	1.000		
Total		.044	71773.809	.000[a]	1.000	1.000		
a. 32 degrees of freedom								

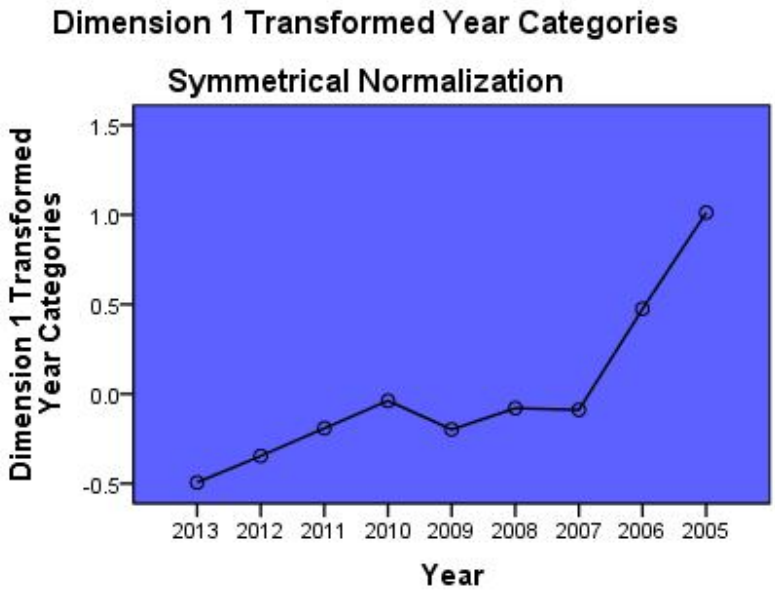
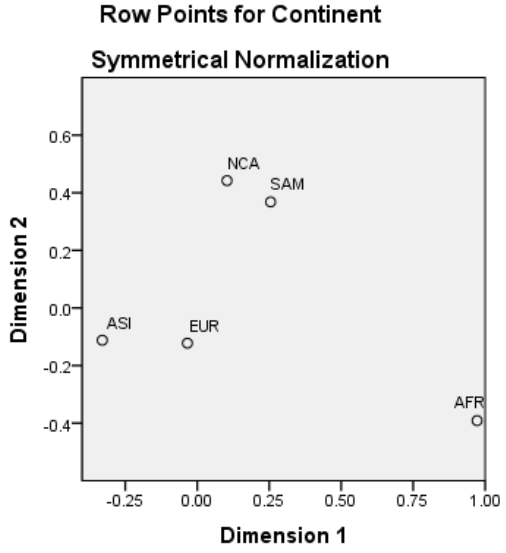


Figure 3 The trend of CL for the continents

Figure 3.The trend of the cutaneous leishmaniasis has been on a steady decrease for the continents of the selected countries



Plot 3 A plot of the CL for the continents.

Table 4. Summary table of VL of the continents.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.250	.062			.950	.950	.001	.022
2	.056	.003			.048	.998	.002	
3	.012	.000			.002	1.000		
Total		.066	30669.721	.000[a]	1.000	1.000		
a. 24 degrees of freedom								

.

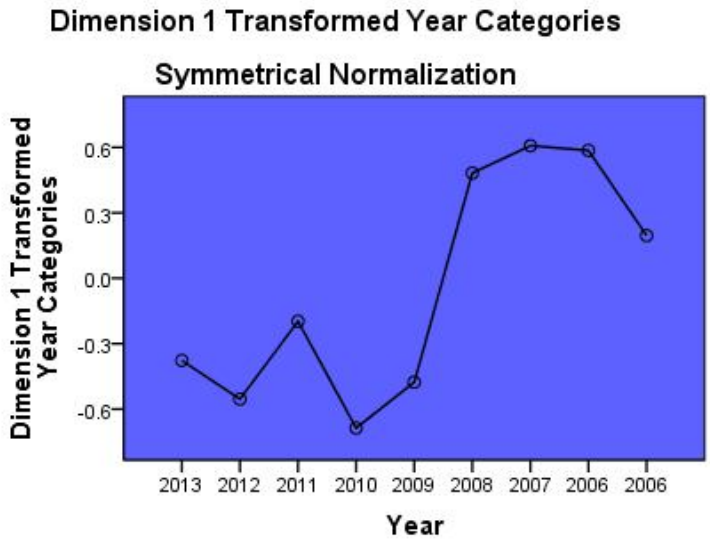
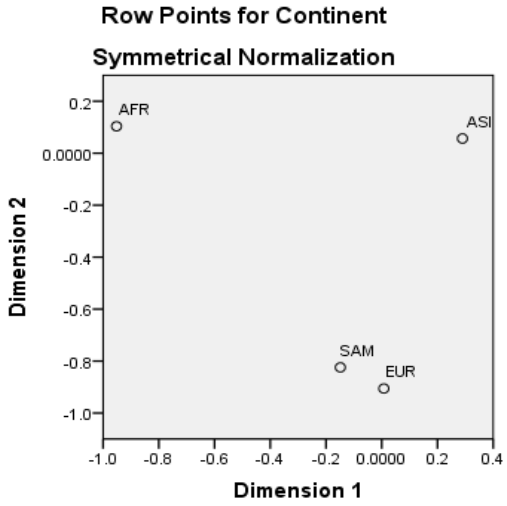


Figure 4 The trend of VL for the continents.

Figure 4.The trend of the visceral leishmaniasis has been on a slight increase after many years of steady decline across the continents of the selected countries.



Plot 4 A plot of the VL for the continents.

Table 5 Summary table of the countries mostly affected by CL.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.267	.072			.694	.694	.001	.198
2	.165	.027			.264	.957	.001	
3	.048	.002			.022	.980		
4	.043	.002			.018	.997		
5	.017	.000			.003	1.000		
Total		.103	126897.685	.000[a]	1.000	1.000		

a. 40 degrees of freedom

Analysis from **table 5** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 126897.6. The total variance explained is 10%. Dimensions 3 to 5 are almost insignificant because they account for little of the total inertia explained.

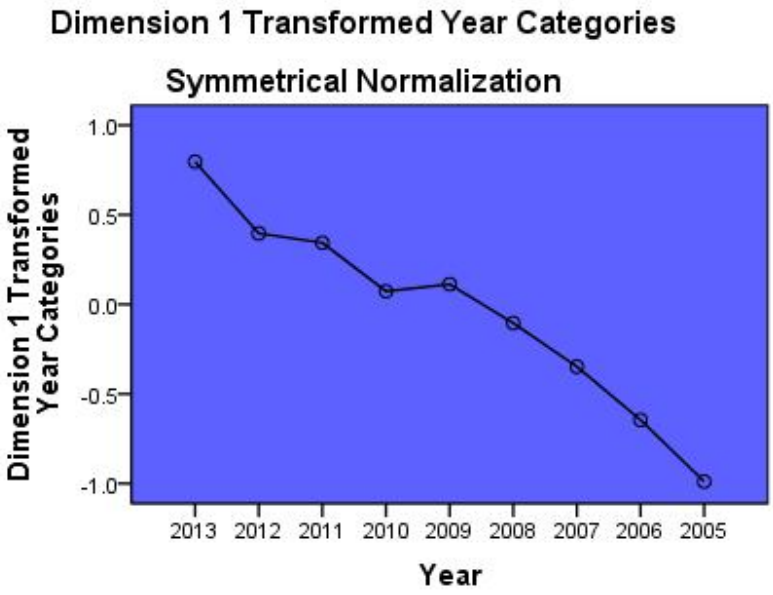
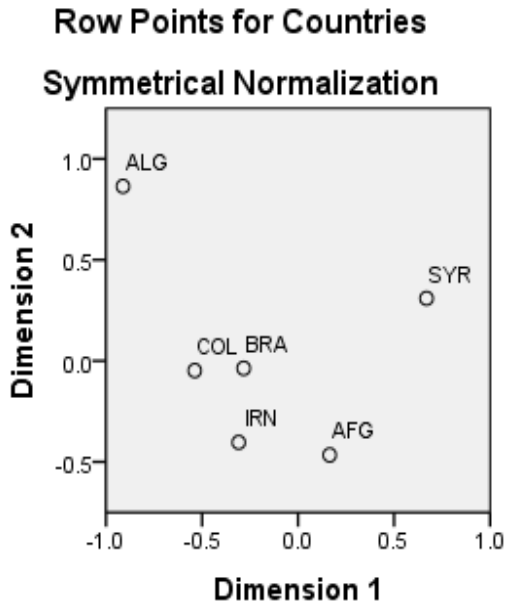


Figure 5 The trend of the CL of 6 most endemic countries.

Figure 5.The trend of the cutaneous leishmaniasis of the 6 most endemic countries has been on a steady increase.



Plot 5 A plot of CL of 6 most endemic countries.

Table 6 Summary table of 6 countries mostly affected by VL.

Summary								
Dimension	Singular Value	Inertia	Chi Square	Sig.	Proportion of Inertia		Confidence Singular Value	
					Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.296	.088			.764	.764	.001	.100
2	.126	.016			.137	.901	.001	
3	.088	.008			.067[b]	.967		
4	.052	.003			.023	.991		
5	.032	.001			.009	1.000		
Total		.115	50253.869	.000[a]	1.000	1.000		

a. 40 degrees of freedom

Analysis from **table 6** shows that the model is highly significant at the 0.000 level with an alpha of 0.05 and chi-square value of 50253.87. The total variance explained is 12%. Dimensions 3 to 5 are almost insignificant because they account for little of the total inertia explained.

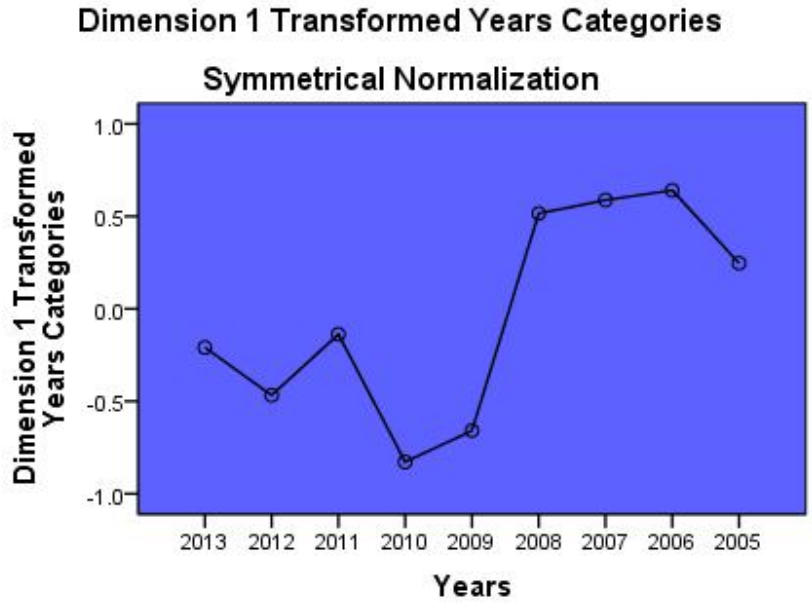
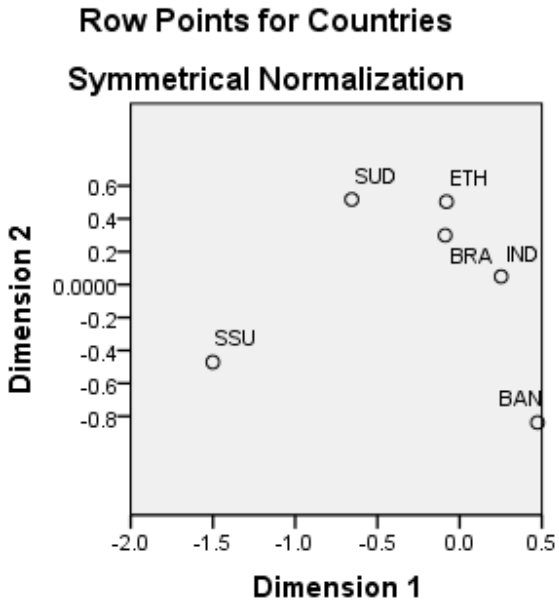


Figure 6 The trend of VL of 6 most endemic countries.

Figure 6.The trend of the visceral leishmaniasis of 6 most endemic countries has been on a slight increase after some years of sharp decrease.



Plot 6 A plot of the VL of 6 most endemic countries.

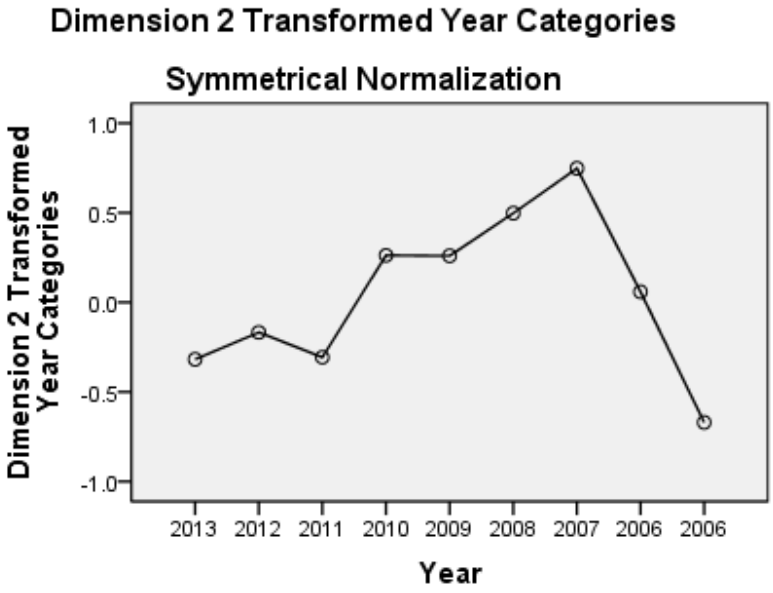


Figure 7 The countries affected by both CL and VL (Trend).

Figure 7.The trend of the cutaneous and visceral leishmaniasis of countries being affected by both has been on a steady decrease for the continents.

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RESEARCH ARTICLE

Investigating the Relationship between Financial Repression and Governmentsize in Iran

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ABSTRACT

This study attempts to investigate the relationship between government size and the financial repression index in Iran from 1373 to 1389. Results of estimating pattern using Auto Regressive Distributed Lag method(ARDL) indicated that our Dynamic pattern moved toward long term pattern. Moreover, the results of error correction pattern demonstrated that 32 percent of deviation rate in the desired model was corrected from its own long term path by pattern's variables in each period. The results of long term estimation revealed that there was a positive relationship between inflation variable as independent variable and financial repression as dependent variable, and also there was a positive relationship between government size variable as the main variable and financial repression.

Key words: government size, interest rate, financial repression

INTRODUCTION

Iran economy faced oil revenues increase since early 1350s which led to more government involvement in economy in order to achieve increasing growth and stable development, but later the issue of economic adjustment, privatization of government enterprises and downsizing of government as well as achieving higher growth rate were placed at the head of government program. Aside from these issues, Iran's admission as an observer member in WTO (world trade organization) and decreasing government efficiency in Iran according to World Bank report in 2006 increased the importance of effectiveness of government cost on economic growth (Komeijani&Nazari, 1388). Therefore, it is necessary to get accurate knowledge about government activities and its impact on the rate of interest

and inflation and establishing financial repression in the country by having a scientific attitude to these issues using available criteria in this area such as government size, economic growth and inflation.

In economic literature, financial repression index is the all-round development of the real negative interest rate (interest rate) and government control command to allocate banking system funds. The basic function of banking system besides financial markets, is to equip financial resources and optimized allocation of it into economy system in order to supportand facilitate production affairs, develop well-being and economic growth and development.The more efficient the banking system operates in equipping financial resources and allocating it in competitive environment, the more reduction in production costs, improvement in production activities, employment and economic growth can be observed. Otherwise, inefficiency of banking system in optimized equipment and allocation of financial resources would cause great costs for economy including reduction in economic growth. The amount of government intervention is one of the effective factors in determining interest rate. Government interferesin determining interest rate for supplying its budget deficit. While governments usually called these interferences which are the consequence of financial repression as a growth improvement policy in their own analysis, the financial repression is actually a method of financial supply of government's budget deficit.Considering the importance of this issue, the aim of the present study was to investigate the relationship between financial repression and government size in Iran.

The current study is organized in 5 sections. The first section includes abstract and introduction. Literature review, theoretical foundations, and background of the study are included in second section. In third section, the model which is used in this study is presented. The forth section is devoted to analysis of experimental results and finally the last section discusses the conclusions.

Literature review

theoretical foundations of the research
Governments' intervention in financial markets through determining the maximum of banking discount interest rate, high rates of legal reserves, intervention in the manner of distributing banking credits, determining restrictive laws and regulations for current account, and investment account minimize banking interest to a level lower than inflation rate and as a result real rate would be negative. These conditions are known as financial repression in economics literature.

The concept of financial repression in the world of Mackinnon in 1973 which introduced the modification of financial repression for the first time, was defined as follows:

When financial repression occurs, exclusively licensed imported activities, specialized large-scale exports of mineral products, the products of support industry, international corporations, and different governmental organizations,...., and even abnormal budget deficit of the government frequently take the limited loanable resources from bank deposits and financial resources of the rest of the economy should be supply from inadequate resources of lenders, owners of pawnbrokers , and cooperatives.

Cevedet and Nicolay (1998) stated that financial repression is a set of policies, formal law and regulations and imposed informal controls by governments on financial sector which deviate the costs of the financial sectors (rate of interest and exchange rate) from its balanced amounts and avoid the maximum available capacity function in financial institutes. According to Roubini and Sala-I- Martin (1999) financial repression is: a set of policies, laws, regulations, taxes, qualitative and quantitative limitations and imposed controls from government which do not allow financial intermediates to operate based on their maximum available capacity. From Stefano (2001) point of view, regarding the provided set of definitions, if in a country a government allocate financial resources of financial intermediates in a cheap cost to selective activities, supplying financial budget deficit and governmental institutes by

determining a set of limiting laws and regulations and avoid the optimized allocation offinancial intermediates resources based on the costs that govern the market, financial repression has happened in that country.

Theoretical foundations of financial repression

believe that interest rate increase in short term because of costs influence will increase inflation Since the World War 1, monetary and fiscal policies of many countries were influenced by Kinz and Tubin's ideas. The phenomena of liquidity trap of Kinz and Tobin model justified the financial repression as such: that keeping interest rate low, taking tax from money, accelerating the growth of money rate, would as a result increase the inflation rate, in order to increase the ratio of capital to money in family assets, and cause employing higher portion of capital to labor force, therefore productivity and per capita income would be higher and ultimately increase prosperity.

Structuralisms and neoclassic and simultaneously decrease economy growth rate by decreasing credit supply (in terms of actual values) in order to supply financial investment and in this way justify financial repression. The other justification of financial repression is hidden in its implicit concept if the limitations and restrictions of government law cannot collect tax adequately to supply its own costs and spends because of available limitations in the society, in this case, financial restrictions and obstacles (inflation, high rates of legal reserves, and maximum of interest rate) might be justify as the second financial supply strategy of government spending.

Until the 1970s the economy of most countries in the world was under the influence of economists who support financial repression. As it was mentioned before, their argument was that increase in interest rate would lead to increase in investments costs and limit economic growth. Therefore, developing countries which are in incomplete occupation situation, select decreasing interest rate policy to lower level of balanced rate to achieve economy aims like rapid economic growth, and stable price levels,…

Government size and the method of measuring government

Government size is a main issue which there are lots of discussions about it and all countries in the world are engaged with this issue. Government size varies in Iran economy in terms of different definitions. Central government, public government, and public sector provide three different definitions and sizes about the role and position of the government in Iran economy (Baz Mohammadi&Cheshmi 1385).

There are various relative and absolute indexes to determine government size in economy. Some of these indexes are: total government spending, taxable income, total value of products in state-owned enterprises, the ratio of government spending to gross domestic production(GDP), the ratio of tax revenues to GDP,…

Literature review

Regarding the conducted studies inside the country, Mehregan et al (1385) studied the casual relation between interest rate and inflation using panel data about 24 countries from 2001 to 2003. The obtained results indicated that increasing interest rate statistically led to increase in inflation rate, and in this way interest rate is the reason of inflation rate, but inflation rate increase could not significantly increase the interest rate of the selected countries.Komeijani and poor rostami (1387) investigated the impact of financial repression on economy growth. Theyexamined the panel data of 92 countries for a period over 1985-2005 in their study and compared the effect of size and intensity of financial repression on economy growth in 33 least developed countries and 38 emerging countries. The results revealed that real negative interest rate had significant negative effect on economic growth.Peter Sjoberg (2003) calculated the central government spending regression in investment variables, private consumption, and interest rate to investigate the effect of government spending on growth using data over 1960-2001 from Sweden. The result of investigation was that private investment, private consumption, and government

investment had positive effects on economic growth, but interest rate, government transferred payment, and government consumption had reverse effects.In another study Niloy Bose (2003) examined the relationship between public sector spending and economic growth using panel data for 30 developing countries during 1970s and 1980s. Results of study demonstrated that current spending had no effect on economic growth, while capital spending had positive effect.

METHODOLOGY

In order to investigate the relationship between financial repression and government size in Iran, present study by employing theoretical discussions and stated experimental considerations and Iran special economic condition, using quarterly data over 1373-1389and based on an Auto Regressive Distributed Lag method (ARDL) which was provided by Sons and Shin (1996), introduced an appropriate pattern as follows.

$$FR_t = \beta_1 + \beta_2 G_t + \beta_3 INF_t + \beta_4 ER_t + \beta_5 OR_t + \beta_6 TR_t$$

Where in the above equation, FR is the financial repression as the dependent variable, G is the government size as the main independent variable, ER is the currency rate as the independent variable, INF is the inflation rate as the independent variable, OR is the oil incomes as the independent variable, and TR is the Taxable income as the independent variable.

In the mentioned model LN was obtainedfrom all variables and all required information and statistics were gathered from published formal resources and turned to quarterly form, and also the amount of financial repression was obtained from following formula:

FR= INT – GOV

Where in the above equation INT represents liquidity ratio to GDP and GOV represents public sector debt to banks to private sector debt to banks ratio. Sons and Shin divided their approach to two steps in order to analyze a co-integration problem in an ARDL pattern. In the first step, at first the long term relationship between variables was investigated using co-integration test, if the variables were not static. In the second step, after proving the relation, the co-integration coefficients of the pattern were estimated. To estimate the self-co-integrated pattern with distributive lags also the number of optimized lags were determined using appropriate criteria such as Akaik (AIC), Schewarz – basin (SBC), and HannanKoein (HQC).

Structural consistency tests

Cumulative sum test (CUSUM)
The null hypothesis based on lack of structural failure was tested by conducting structural consistency test using statistic (CUSUM). This means that if accumulation waste graphs get out of 0.95 confidence interval (in other words cross the confidence interval) the null hypothesis based on lack of structural failure will be rejected and structural failure will be retained. Statistic (CUSUM) was used to find systematic changes (Abrishami&MehrAra, 1381, P. 96).

RESULTS

Evaluation of variables' consistency degree:To evaluate variables consistency used in the model, the Dicky- fuller test and generalized Dicky- Fuller were employed and test results at the level for all used variables in each model in Table (1)variables are a sum ofzero-order. ARDL method can be used to examine co-integration. All variables are stable.

Results of dynamic estimation (short-term)

At this stage, to ensure that there was a long term ARDL dynamic model relationship with lags which were determined by Schewarz- Baisn by means of system, short-term dynamics of the model were estimated in the following table (2). According to estimated results of table (2), estimated model is as follows:

FRt=0/39+0/67FR(-1)+1/81G-1/37G(-1)+0/12G(-2)-0/78ER+0/56ER(-1)+0/2INF
+1/90OR+1/25TR+1/06TR(-1)-0/53TR(-2)+0/01TREND

Estimation of long-term equation of model

After estimating the dynamic model (short-term) and supporting long-term relationship, estimation of this relationship was performed. The results of long-term estimation are presented in table (3).

3-4 to evaluate the results, ECM model was used in order to find out what percents of short-term imbalances of the model decrease toward long-term. The obtained results of estimating error correction model is presented in table(4)

As it can be seen, the estimated coefficients are consistent with theoretical foundations. The coefficient of determining model is 99% which indicates the high explanatory power of the model. Also diagnostic tests confirmed all classic assumptions (lack of autocorrelation, correct conditioned form, normality of residual sentences, and consistency variance) for the desired model.

It should be noted that in using ARDL method, before estimating long-term coefficients, statistic t should be calculated and compared with table of quantities provided by Benrji-Dolado and master, because the condition of long-term coefficient reliability is to have greater absolute value above statistic from corresponding quantity in the table. The desired t quantity to do this test was calculated as follows. Numerator is the sum of variables coefficient with optimized lag related to dependent variable and denominator is the sum of standard deviations of these coefficient.

$$T=\frac{\sum_{i=1}^{p}\alpha_i-1}{\sum_{i=1}^{p}\sigma\alpha_i}=\frac{./57-1}{./08}=-4/125$$

Computational statistic equals to -4.125, because the absolute value of this statistic is more than the critical value of Benjri, Dolado, and master(-2.52)table. Therefore, null hypothesis based on lack of co-integrationbetween pattern variables was rejected and the availability of long-term balanced relation between variables of above patternwas confirmed.

According to estimated results of the table (4), government size variable (G) was significant and its coefficient of elasticity demonstrated the positive influence of this variable on financial repression. Currency rate variable (ER) was also significant and its coefficient of elasticityindicated the negative effect of this variable on financial repression and the variables of oil incomes (OR) and taxable incomes (TR) were not significant.

First hypothesis: there is a positive and significant relationship between government size and financial repression. Based on the results of estimating long-term equation, the first hypothesis is confirmed and by increasing government size, financial repression increases as well.

Second hypothesis: there is a positive and significant relationship between inflation rate and financial repression index. According to the results of estimating long-term equation, the second hypothesis is supported and by increasing inflation rate, financial repression increases too.

What is most important in error correction model more than the others is the sentence coefficient of error correction ECM(-1) which indicates the relatively low speed of adjustment process of imbalance. As it can be seen, this coefficient is significant and negative and supports co-integrationbetween variables. According to theoretical expectations, if we move from one period to the other, 0.32 percent of distortion rate in the function of development level will be corrected from its long-term path by variables of the pattern in the next period. Hence, movement toward balance will be with high speed.

Cusum (cumulative sum) test has been done on the basis of cumulative sum of recursive residuals. In this test cumulative residuals which were distorted from critical lines, representedinconsistency in the parameters of the model. As it can be seen from figure (1-4) cumulative residuals did not distorted from critical lines, therefore the test concluded the consistency of the coefficient of the model. On the other hand, this test demonstrated the square of cumulative residuals which did not distort from critical lines and also the consistency of this model. So the null hypothesis based on availability of structural consistency was accepted and lack of that was rejected.

CONCLUSION

The aim of this study was to measure the relationship between financial repression, government size, inflation rate, currency rate, oil incomes, and taxable incomes on financial repressibility. The results of generalized Dicky-Fuller test indicated that the data related to all variables at I(O) period were become constant. Based on Schewarts- Basin criteria, the amount of optimized lag was zero.

The government size variable (G) was also significant and its coefficient of elasticity represented the positive effect of this variable on financial repression level, and assuming that all the other factors were constant, 1% change in this variable might cause financial repression to change to 1.75 %. Inflation rate variable (INF) was significant and its elasticity coefficient indicated its positive effect on the growth of financial repression in Iran, assuming that all the other factors were constant, 1% change in inflation would change the financial repression of the country to .69%.Regarding the positive relation of government size and financial repression, it is expected that financial release would occur by downsizing the government size and the government budget deficit should be supplied from other ways (such as increasing other incomes) in order to decrease both financial repression and inflation rate. Although downsizing the government and lowering the government spending share of GDP could lead to prosperity, the government should emphasize more on public spending. It is expected that congestion in private sector particularly private investment increase by downsizing the government. And inflation and currency rate reduced.

Special suggestions

According to Article 44 of the constitution, "the government must take steps towards transferring activities and reducing its tenure" and in this regard the amount of government intervention in economy should be limited and its aims should be determined properly because financial repressibility reduce and economic growth increase by downsizing government, therefore it is suggested that:supplying government budget deficit should be done by other ways than intervention in determining interest rate of banking facilities.

Establishing programs to reduce inflation rate in order to raise investment and increasing government revenue, reducing government budget deficit, and decreasing financial repression too.Increasing taxes to reduce government budget deficit.

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Table (1): The results of generalized Dicky- Fuller test

Variable	Dicky-Fuller Test				lag	Calculated statistic t	results
	Dicky-Fuller Statistic	Makinon critical values					
		AIC	SBC	HQC			
FR	-3/48	-161/03	-164/27	-162/31	I(0)	-4/05	Static
G	-3/48	-131/81	-135/05	-133/09	I(0)	-4/31	Static
INF	-3/48	-99/21	-102/45	-100/49	I(0)	-3/89	Static
ER	-3/48	-24/10	-27/34	-25/38	I(0)	-4/32	Static
OR	-3/48	-53/11	-56/35	-54/38	I(0)	-4/76	Static
TR	-3/48	-34/70	-37/93	-35/97	I(0)	-4/84	Static

Source: research calculations

Table(2): the results of estimation by ARDL method

Result	Prob	Statistic t	Coefficient	variable
Significant	0/000	7/91	0/67	FR(-1)
Significant	0/000	18/45	1/81	G
Significant	0/000	-0/18	-1/37	G(-1)
Significant	0/004	3/02	0/12	G(-2)
Significant	0/014	2/56	0/22	INF

Significant	0/000	-6/73	-0/78	ER
Significant	0/000	4/17	0/56	ER(-1)
Nosignificant	0/548	-0/60	-1/90	OR
Nosignificant	0/767	0/29	1/25	TR
Significant	0/000	4/32	1/06	TR(-1)
Significant	0/003	-3/11	-0/53	TR(-2)
no significant	0/315	1/01	0/39	C
No significant	0/058	1/94	0/01	TREND
F= 13307.7DW=2/15 prob=0/000 R^2=0/99				
F A: serial correlationLM=1/60 pr0b=0/808				
F: Functional FORMLM=1/99 prob=0/158				
C: normality LM=1/67 prob=0/455				
F:Hetroscedasticit:D LM=2/39 prob=0/122				

Source: Research calculations

Table (3) : The results of long-term relationship for dependent variable (FR)

Result (confidence 95%)	**Probability level**	**Statistic t**	**Coefficient**	**Variable**
Significant	0/000	6/88	1/75	G
Significant	0/026	2/29	0/69	INF
Significant	0/013	2/59	-0/68	ER
No significant	0/543	-0/61	-5/93	OR
No significant	0/667	0/43	5/55	TR
No significant	0/299	1/05	1/23	C
Significant	0/021	2/61	0/03	TREND

Source: Research findings

Table (4)- results of estimating error correction model

Result (confidence 90%)	Probability level	Statistic t	Coefficient	Variable
Significant	0/000	18/45	1/81	dG
Significant	0/004	-3/02	-0/12	dG1
Significant	0/013	2/56	0/22	dINF
Significant	0/000	-6/73	-0/78	dER
no significant	0/547	-0/60	-1/90	dOR
no significant	0/767	0/29	1/25	dTR
Significant	0/003	3/11	0/53	dTR1
no significant	0/315	1/01	0/39	dC
Significant	0/058	1/94	0/01	Dtrend
Significant	0/000	-3/75	-0/32	Ecm(-1)
F=6965/2	prob=(0/000)	$R^2 = 0/99$	D.W=2/15	

Source: Research calculations

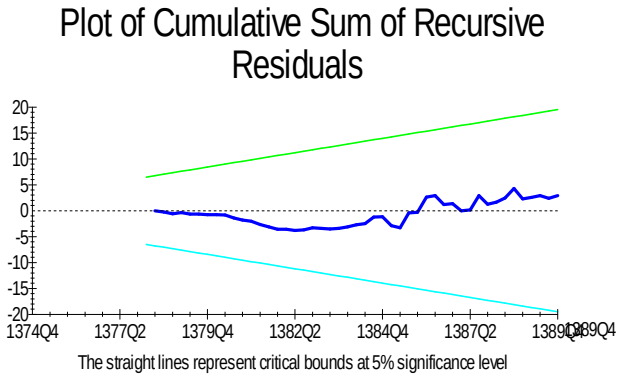

Fig 1.3-5 structural consistency of model test

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RESEARCH ARTICLE

Studying the Effect of Collaborative Learning on Self-Efficacy of High School Students from the Perspective of Mathematics Teachers

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ABSTRACT

This study examined the effect of collaborative learning on self-efficacy of high school students from the perspective of mathematics teachers, research methodology is descriptive survey. The population of this study is all high school mathematics teachers in Zahedan who are 177 people. Sampling was done by available samples method, which included 80 in-service teachers in the Department of Mathematics of the Institute of Education. In this research data collection tool was a researcher made questionnaire containing 12 questions. To estimate test reliability, Cronbach's alpha coefficient was used where coefficient alpha coefficient for the questionnaire was 0.81. Obtained data was analyzed using statistical parameters such as mean and univariate t. Based on the results, it can be stated that from the perspective of mathematics teachers collaborative learning has an impact on increasing students' self-efficacy.

Keywords: mathematical education, collaborative learning, self-efficacy, views of math teachers

INTRODUCTION

A few decades ago, many of the countries of the world had a growing concern about training the skills and lack of adequate preparation for the skills and knowledge necessary for citizens to live and work better and have a chance of success in today's complex society, thus, in response to these concerns, improving the education system, training methods and training programs became the focus. At the same time, many educational practices accepted the teaching methods based on traditional behavioral approach which considered teaching basically as "expressing" and "transferring" of facts and information to students (like filling the glass empty), and these methods have failed in

nurturing talent and ability needed by the students in their daily life. In collaborative learning approach, learning gets pleasant for all students, educational opportunities become equally available to all students, the spirit of cooperation and participation increases and all students in the class are called for thinking and creativity [1]. The students, who learn through active learning, learn better and enjoy the learning experience more. One of the most important strategies of collaborative learning approach in making students active in learning process is using study groups and providing discussion opportunities. It looks as if through collaborative learning such an opportunity can be better provided. Because in this way students work in small heterogeneous groups to achieve a common goal and try to maximize their own and others' learning [2]. Group discussion in the classroom or in other words collaborative learning methods such is of strategies that increase self-awareness and self-efficacy of students in their learning process [3]. One of the most important theories of behavior change in the field of learning is Bandura's self-efficacy theory [4]. According to this theory among private mechanisms; none of them is more fundamental and more comprehensive than self-efficacy in behavior and environmental demands. Academic self-efficacy, in particular, is to ensure meaningful academic tasks such as reading books and answering questions in class and readiness for test. High levels of academic self-efficacy leads to higher mean scores and stability to complete assignments, so students with higher academic self-efficacy have better academic adaptability and use more useful learning strategies and, ultimately, will have better performance [5].

Based on Bandura's social-cognitive theory [4] and according to numerous studies including work of Pajares and Miller [6] and Greene et al. [7], self-efficacy as an important factor has an role effective in predicting academic achievement at different levels and in specific areas [8]. Self-efficacy is a part of a person's self-concept that is related to their beliefs about the ability to perform tasks they will face in the future. Efficacy includes the belief in the ability to achieve goals in a specific academic area [9].The present study aims to investigate the question of whether collaborative learning has any effect on high school students' self-efficacy from the perspective of mathematics teachers.

MATERIALS AND METHODS

In this section research methodology, sampling techniques, estimating the sample size, research tools, validity and reliability of tests and statistical methods used in the study are discussed.

Research Method: Regarding the purpose the study is applied, because it is carried out in order to have the results resolve issues. And regarding the nature, it is descriptive, as it deals with the real issue of the research and expression of the subject through descriptive data collection, and does not deal with how it is, but it is merely concerned with the current situation. This research is survey regarding implementation, because using a questionnaire; it investigates the experts' idea on the subject.

Statistical Population, Sample and Sampling Method: The population in this study is all high school mathematics teachers are in Zahedan who are 177. Sampling was done by available sampling, including 80 in-service teachers in classes in the Department of Mathematics at the Institute of Education.

Data Collection Method and Instrument: In this study, data collection tool is a questionnaire with 12 questions developed by the researcher after studying the literature and consulting the Supervisor. Cronbach's alpha coefficient was used to estimate test reliability and the alpha coefficient was obtained as 0.81, as a result, the reliability of the test was confirmed.This questionnaire was designed by five-point grading scale according to Table 1.

Statistical Methods for Data Analysis: At this stage, data were analyzed using descriptive and inferential statistical tests (univariate t) using 17 SPSS software package.

DATA ANALYSIS

To launch a research project in a scientific method, using the right tools and information and sufficient evidence researchers for measurement and evaluation, and using the identified method summarize, set, and classify the data and present them by tabloid, statistical tables, and examples. In this section, according to the research questions, obtained information was analyzed using univariate t test.

Analysis of Demographic Data: Description of the distribution of gender, educational level, and mathematics teachers' experience of high school are given in Figures 1, 2 and 3.As shown in Figure 1, sixty five percent of teachers are women and 35 percent are men. Figure 2 shows descriptions of education teachers. Results in Figure (2) show that 48 teachers (60%) of teachers have a bachelor's degree and 32 teachers (40%) have master's degree. Figure 3 describes the experience of teachers. The results of Diagram 3 show that 31 teachers (75/38%) have less than 10 years of service and 22 (27.5%) have 20 years and more. Therefore, there is not a huge difference between teachers' statistics of work experience.

Studying Questionnaire Questions: To test the main hypothesis of the research, which is as below, learning collaborative learning from mathematics teachers' point of view has effect on self-efficacy of high school students. According to studying the literature on self-efficacy, issues that are related to increasing students' self-efficacy, 12 questions have been analyzed.

1 - Can students solve the problems in the textbook better through cooperation and partnership in classroom?

To test this question, univariate t-test was used whose results are given in Table 2.

As the results of Table 2 show, the mean scores of teachers for collaboration and participation in groups to solve problems of textbook was obtained as 3.77, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 3.89 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that through cooperation and participation, students can solve textbook problems much better in the classroom.

2. Do students' cooperation and participation have an effect on students' mastering the material that they do not like?

To test this question, univariate t-test was used whose results are given in Table 3.

As the results of Table 3 show, the mean scores of teachers for collaboration and participation in groups to commanding the subjects students do not like 5 was obtained as 3.55, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 3.44 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that collaboration and participation in groups have an effect on students' commanding the subjects they do not like.

3- Do cooperation and participation of students in the classroom have an effect on increasing students' motivation?

To test this question, univariate t-test was used whose results are given in Table 4.

As the results of Table 4 show, the mean scores of teachers for collaboration and participation in increasing students' motivation was obtained as 3.99, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 3.56 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on improving students' motivation in the classroom.

4. Do students' cooperation and participation in the classroom has an effect on solving difficult problems?

To test this question, univariate t test was used whose results are given in Table 5.

As the results of Table 5 show, the mean scores of teachers for collaboration and participation in solving difficult problems was obtained as 3.87, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 3.62 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words,

teachers believe that students' cooperation and participation in class have an effect on students' solving difficult problems in the classroom.

5. Do cooperation and participation have an effect on students' participation in class discussions?

To test this question, univariate t-test was used whose results are given in Table 6.

As the results of Table 6 show, the mean scores of teachers for the effect of collaboration and participation on students' participation in class discussions was obtained as 4.07, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 4.21 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have an effect on students' participation in the classroom discussion.

6. Does students' participation in discussions and exchanging ideas with each other have an effect on challenging teachers' ideas in the classroom?

To test this question, univariate t test was used whose results are given in Table 7.

As the results of Table 7 show, the mean scores of teachers for the effect of collaboration and participation on challenging teachers' ideas in class was obtained as 4.65, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 5.66 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on challenging teachers' ideas in the classroom.

7. Do cooperation and participation of students in the classroom have an effect on explaining a concept to other students?

To test this question, univariate t-test was used whose results are given in Table 8.

As the results of Table 8 show, the mean scores of teachers for the effect of collaboration and participation on explaining a concept to other students was obtained as 4.35, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 5.11 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on explaining a concept to other students in the classroom.

8. Do cooperation and participation of students in the classroom have an effect on getting good grades?

To test this question, univariate t-test was used whose results are given in Table 9.

As the results of Table 9 show, the mean scores of teachers for the effect of collaboration and participation on getting good grades was obtained as 4.16, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 4.89 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on getting good grades in the classroom.

9. Do cooperation and participation of students in the classroom have an effect on the attendance of students in dull classes?

To test this question, univariate t test was used whose results are given in Table 10.

As the results of Table 10 show, the mean scores of teachers for the effect of collaboration and participation on the attendance of students in dull classes was obtained as 3.48, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 3.59 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on the attendance of students in dull classes in the classroom.

10. Do cooperation and participation of students in the classroom have an effect on students' understanding of most of issues discussed in class?

To test this question, univariate t-test was used whose results are given in Table 11.

As the results of Table 11 show, the mean scores of teachers for the effect of collaboration and participation on students' understanding of most of issues discussed in class was obtained as 4.41, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 5.12 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on students' understanding of most of issues discussed in class.

11. Do cooperation and participation of students in the classroom have an effect on careful listening of students to difficult problems during teachers' lecture?

As the results of Table 12 show, the mean scores of teachers for the effect of collaboration and participation on students' attentive listening to difficult issues during teachers' lecture was obtained as 4.05, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 5.10 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on students' attentive listening to difficult issues during teachers' lecture in class.

12. Do cooperation and participation of students in the classroom have an effect on students' dealing with challenging issues?

As the results of Table 13 show, the mean scores of teachers for the effect of collaboration and participation on students' dealing with challenging issues was obtained as 4.33, which is higher than the mean of the hypothesis that is 3, and the difference with the value of t is calculated as 5.98 and 79 degree of freedom at 99 percent significance level ($p<0.01$). In other words, teachers believe that students' cooperation and participation in class have a great effect on students' dealing with challenging issues in class.

Now, based on analysis of the 12 questions above, we survey the research hypothesis.

As the results of Table 14 show, the mean scores of teachers for the effect of collaboration and participation on students' self-efficacy was obtained as 48.67 which is higher than average that is 36 and the difference with the value of t is calculated as 10.27 and 79 degree of freedom at 99 percent significance level ($p<0.01$).In other words, teachers believe that the collaborative learning has effect on students' self-efficacy.

RESULTS AND CONCLUSION

The results of the research are presented in this section:

Research Hypothesis: collaborative learning has an effect on self-efficacy of high school students from the perspective of mathematics teachers. The obtained results in studying the above hypothesis show that collaborative learning students has a great effect on students' solving difficult problems, getting mastery over the subjects they do not like, increasing their motivation, participation in class discussions, challenging the idea of the teacher in the classroom, explaining a concept to another student, getting good grades, and regular attendance of students in dull classes, understanding more about the issues raised in the classroom, listening carefully to the speeches during the difficult issues and facing challenging problems. As a result, it is effective in increasing efficacy of the students, and these results are consistent with the findings of Hwang et al. [10] which showed that cooperative learning increases enthusiasm for learning and gets in line with mutual trust and respect and verbal skills and leadership in students, and also Faqhihi [11] which shows that collaborative learning benefits everyone the academic achievement of all students (including girls, boy, strong, weak, medium, urban or rural) almost equally. And it is consistent with the results of Aali [12] which showed that the students have a positive attitude towards collaboration and believe that cooperative method facilitates their learning and brings about favorable conditions for learning, and also consistent with Nissi et al. [13] results which showed that participatory training and learning compared to traditional education increases academic performance, self-concept and motivation of students.

Therefore, it can be concluded that students learn through active learning, learn better and enjoy learning experience. One of the most important strategies to enable students in the learning process is using study groups and

providing opportunity for discussion. It looks that through collaborative learning this opportunity can be provided better, because in this way, the students in small heterogeneous groups work together to achieve a common goal and try to maximize their and others' learning.

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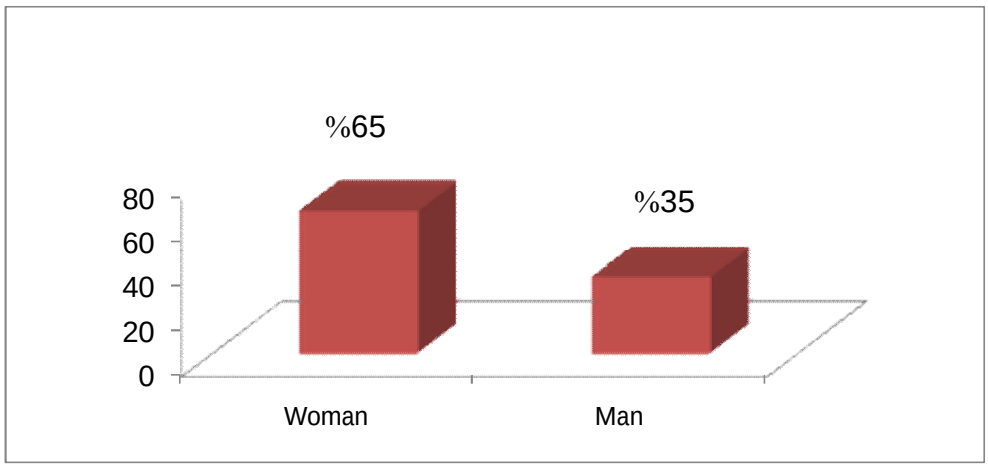

Figure 1: Descriptions of sexuality

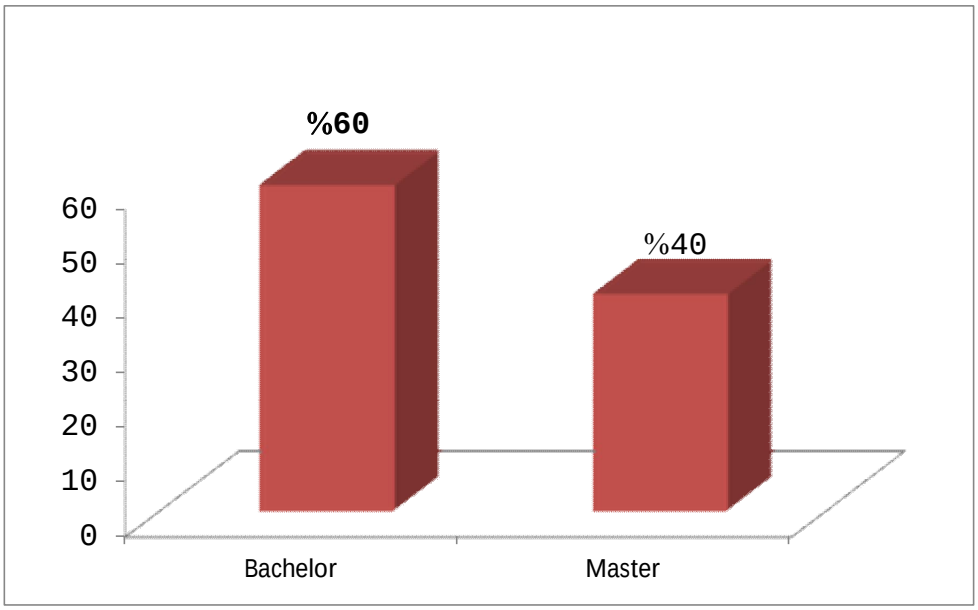

Figure 2: Descriptions of education teachers

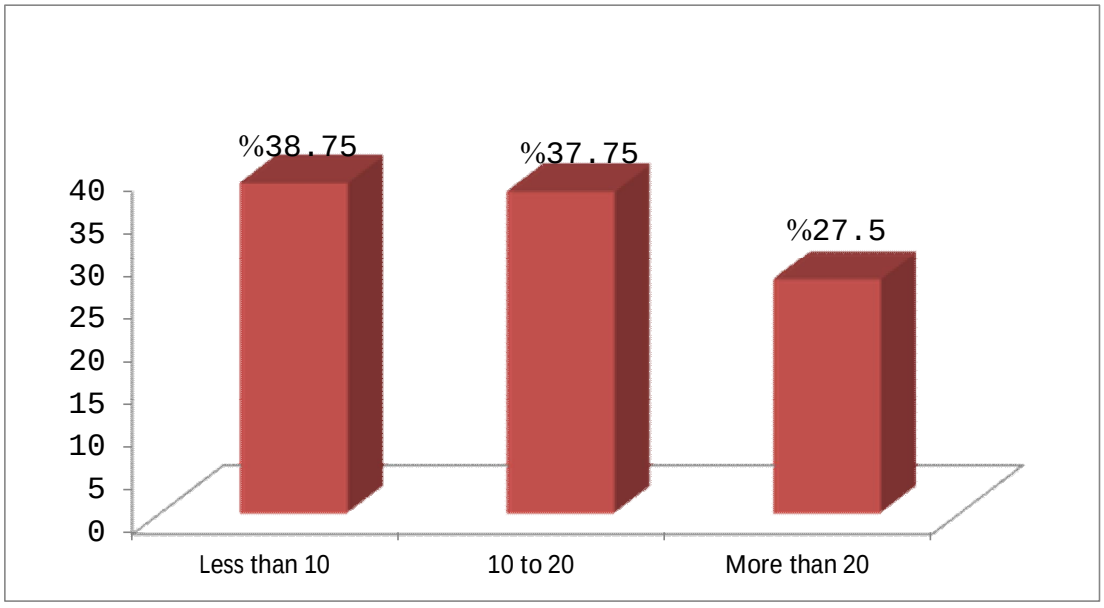

Figure 3: Experience of teachers

Table 1: Scoring the questionnaire

SCORE	1	2	3	4	5
QUALITY	Very low	Low	Medium	High	Very high

Table 2: Statistical analysis of question 1

Index	Mean	SD	t-value	t	Freedom	Significance
Solve problems in textbook	3.77	1.21	3	3.89	79	0.01

Table 3: Statistical analysis of question 2

Index	Mean	SD	t-value	t	Freedom	Significance
Effect students' mastering	3.55	1.27	3	3.44	79	0.002

Table 4: Statistical analysis of question 3

Index	Mean	SD	t-value	t	Freedom	Significance
Effect increasing students' motivation	3.99	1.28	3	3.56	79	0.01

Table 5: Statistical analysis of question 4

Index	Mean	SD	t-value	t	Freedom	Significance
Effect solving difficult problems	3.87	0.95	3	3.62	79	0.01

Table 6: Statistical analysis of question 5

Index	Mean	SD	t-value	t	Freedom	Significance
Effect students' participation	4.07	1.37	3	4.21	79	0.00

Table 7: Statistical analysis of question 6

Index	Mean	SD	t-value	t	Freedom	Significance
Effect challenging teachers' ideas	4.65	0.27	3	5.66	79	0.00

Table 8: Statistical analysis of question 7

Index	Mean	SD	t-value	t	Freedom	Significance
Effect explaining concept	4.35	1.02	3	5.11	79	0.01

Table 9: Statistical analysis of question 8

Index	Mean	SD	t-value	t	Freedom	Significance
Effect getting good grades	4.16	1.05	3	4.89	79	0.01

Table 10: Statistical analysis of question 9

Index	Mean	SD	t-value	t	Freedom	Significance
Effect attendance	3.48	1.12	3	3.59	79	0.01

Table 11: Statistical analysis of question 10

Index	Mean	SD	t-value	t	Freedom	Significance
Effect students' understanding	4.41	1.01	3	5.12	79	0.01

Table 12: Statistical analysis of question 11

Index	Mean	SD	t-value	t	Freedom	Significance
Effect careful listening	4.05	0.88	3	5.10	79	0.00

Table 13: Statistical analysis of question 12

Index	Mean	SD	t-value	t	Freedom	Significance
Effect students' dealing	4.33	0.34	3	5.98	79	0.00

Table 14: Statistical analysis of collaborative learning on self-efficacy

Index	Mean	SD	t-value	t	Freedom	Significance
self-efficacy	48.67	12.45	36	10.27	79	0.00

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RESEARCH ARTICLE

Adapting to Climate Change: Strategies of Millet Growing Farmers in Tamil Nadu

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ABSTRACT

In the backdrop of serious consequences of climate change for Indian agriculture, it is imperative to examine whether and how the farmers perceive climate change and the nature of adaptation strategies they pursue to overcome the negative impact of climate change on agriculture. The present study was conducted with the objective of analysing the perception and adaption strategies followed by millet growing farmers' towards climate change. Analysis of farmers' perception about temperature and rainfall reveals that farmers perceived increase in temperature over time, while rainfall decreased over the years. The farmers' perception about temperature and rainfall are almost in congruity with climatic data obtained from meteorological stations. In case of adaptation strategies most of the farmers changed their sowing dates and varieties in order to cope with the constraints imposed by climate change. The estimation of multinomial logit model was done by using various adaptation strategies as dependent variables and the results were given away.

Keywords: Climate Change, Adaptation Strategies, Multinomial Logit Model

INTRODUCTION

Agricultural production is determined by a multitude of factors influencing both the area under crops and crop yields. These factors include climate, input and output prices, soil, capital availability for agricultural sector, pests and diseases, etc. Nevertheless, climate is the most important factor that influences agricultural production (Efe,

2009). Climate has changed in the past and will continue to change in the future and therefore it emphasizes the need to understand how farmers perceive and adapt to changing climate. An understanding of the farmers' perception of climate change, that is, changing magnitude of temperature and changes in both the quantity of distribution of rainfall is a necessary prerequisite for climate change adaptation in agriculture. Farmers who perceive the climate change necessarily make adjustment in their farming practices in order to mitigate the negative effects of climate change. Higher temperatures, reduced rainfall and increased rainfall variability reduce crop yield and threaten food security in low income and agriculture based economies (Palanisami *et* al., 2009; Deressa *et* al, 2011).Since millets are grown mainly in dry zones as rain-fed crops, under marginal conditions of soil fertility and moisture, the implications of erratic rainfall and increasing temperature are the serious challenges to sustain and increase their production in future..Tamil Nadu is mostly dependent on monsoon rains and hence the state's agriculture is prone to droughts and erratic monsoon patterns. The state has two distinct periods of rainfall, 1. South west monsoon, 2. North east monsoon. The annual average rainfall in the state is 970 mm, and the water resources are limited. Its climatic conditions are favourable to grow a variety of millet crops, though with low yield. Considering the continuing significance of millets in household security, it is necessary to clearly understand the adaptations strategies followed by millet growers in order to devise appropriate policies to enhance their capacity to cope with changing climate

METHODOLOGY

Data Collection

The study was conducted in predominantly millet-growing districts of Tamil Nadu viz., Krishnagiri, Villupuram, Erode, Namakkal, Perambalur, Dindigul and Thoothukudi districts which were purposively selected for the study. A total of 240 millet farmers were contacted individually and interviewed using pre-tested questionnaires to collect data and information on various socio-economic characteristics of farm households, millet cultivation, and the farmers' perception and adaptation to climate change. Rainfall and temperature were collected from the year 1971 to 2010 for all the districts of Tamil Nadu from Indian Meteorological Department. The IMD weather stations are not present in all the districts of Tamil Nadu. For the sample districts not having the weather station, we took the averages of surrounding districts climatic data to represent the districts without weather station. Descriptive statistical analysis was used to characterize farmers' perception on changes in temperature and precipitation as well as various adaptation measures being used by farmers. Multinomial logit model was used to investigate the factors influencing the farmers' decision in choosing adaptation strategies. The model is described below.

Multinomial Logit Model (MNL)

Multinomial logit model was used to analyze the determinants of farmers' choice of adaptation strategies in the study area. The advantage of the MNL is that it permits the analysis of decisions across more than two categories, allowing the determination of choice probabilities for different categories.

The MNL model is expressed as follows:

$$P\left(y = {}^{j}/_{x}\right) = \frac{exp(x\beta_j)}{[1 + \sum_{k=1}^{J} exp(x\beta_k), j = 1, \ldots \ldots J]}$$

To describe the MNL model, let y denote a random variable taking on the values {1, 2, . . ., J} for J, a positive integer, and let x denote a set of conditioning variables.X is a 1*K vector with first element unity and βj is a K*1 vector with j = 2, …, J. In this case, y denotes adaptation options or categories and x contain different household and environmental attributes. The question is how the changes in the elements of x affect the response probabilities (P(y = j/x), j = 1, 2, . . ., J). Since the probabilities must sum to unity, P(y = j/x) is determined once we know the probabilities for j = 2, . . ., J.

For this study, the adaptation options or response probabilities are seven as described in below;

1. Change in variety
2. Change in cropping pattern
3. Change in sowing dates
4. Mixed/Inter cropping
5. Growing tree crops
6. Soil and Water Conservation Practices
7. No adaptation

The parameter estimates of the MNL model provide only the direction of the effect of the independent variables on the dependent (response) variable. The marginal effects represent the actual magnitude neither change nor probabilities. Differentiating the above equation with respect to the explanatory variables provides marginal effects of the explanatory variables given as:

$$\frac{\delta P_j}{\delta x_k} = P_j\left(\beta_{jk} - \sum_{j=1}^{J-1} P_j \beta_{jk}\right)$$

The marginal effects or marginal probabilities are functions of the probability itself and measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable from the mean. To estimate the parameters of the model we consider the method of maximum likelihood.

RESULTS AND DISCUSSION

Behaviur Of Climatic Variables

The behavioural pattern of climate variables namely the total rainfall and average temperature for the selected districts were analyzed and the results and presented in figures 1 to 4.

Rainfall

Rainfall is one of the important factors in crop cultivation (the primary source of irrigation water). It could be observed from the graph 1 and 2 that there has been awide fluctuation in rainfall in all the districts. It shows the uncertainties and irregularities in rainfall pattern. The inter-annual variability in rainfall was perceptible with the total annual rainfall varying from 18 mm to 1350 mm in Namakkal district, while its range in Dindigul district was from 710 mm to 1650 mm. The annual rainfall in Thoothukudi district varied from 350 mm to 1400 mm. In Erode, Perambalur and Krishnagiri districts the variation in total annual rainfall was in the range of 330 mm to1300 mm. The annual rainfall in Villupuram district varied from 800 mm to 1900 mm per year. Hence, there has been a wide fluctuation in rainfall in the selected districts.

Temperature

Apart from the variability in rainfall, temperature also is an important factor in determining crop production. The graphs in Figure 3 show that the mean temperature of all the selected districts hovered around 27°C to 28 °C. The maximum of mean temperature observed from the dataset was 29.92°C and the minimum of mean temperature is 26.14°C.Though the variability in mean temperature smaller as compared to the fluctuation in rainfall, there has been a general increasing trend in mean temperature over time in most of the districts.

Coefficient of Variation

The coefficient of variation for rainfall and temperature was worked out for the sample districts. The results were furnished below in table 1.

The average temperature was taken for the analysis. While comparing the values the variation was high in Tuticorin and Erode district and it was low in Krishnagiri and Namakkal district among the selected districts. The total rainfall was taken for the analysis. The variation was high in Tuticorin, Erode and Perambalur and its was found to be low in Dindigul district.

Farmers' Perception on Climate Change

The farmers' perception on the climate change was assessed by interviewing the farmers individually and the results are presented in Table 2. Most of the farmers were not able to express their perception on climate change directly but they expressed through the effects or the changes that occurred compared to the earlier years or based on their elder's experiences. In case of rainfall about 85 per cent of the farmers perceived decrease in rainfall over the years. About 35 per cent of the farmers reported that rainfall has become more irregular in recent times in terms of the intensity, rainy days and timeliness. About18 per cent and 4 per cent of the farmers perceived delayed onset and early onset of monsoon rainfall respectively. A very small percentage of farmers (1.25 per cent) had no idea about the changes in rainfall.

More than three-fourth of the sample respondents, perceived an increase in temperature over the years and about 15 per cent of the farmers perceived that the rainfall is normal over the years. Less than five per cent of the farmer's perceived decrease in temperature, while a small fraction of respondents (1.25 per cent) has reported to have no idea about the changes in temperature.

Upon comparing the actual rainfall pattern with farmers' perception it was found that the inter-annual variation in rainfall was high and the farmers in the study area also perceived the same in terms of irregularity and decrease in rainfall. In case of temperature, majority of the farmers perceived a rise in temperature and it was found to be corroborated by the meteorological station data. From the table it is clear that the level of farmers' perception on the climate change was moderately good.

Farmers' Adaptation Strategies

The various adaptation strategies followed by millet growers in the study area are shown in Figure 5. Majority of the farmers (42.5 per cent) resort to changing the sowing dates to cope with changing climatic conditions. The change in the rainfall was reported to be the main reason for the change in sowing dates. About 17.08 per cent and 13.75 per cent of the farmers changed the varieties and also adopted mixed- and inter-cropping strategies respectively. About 7.91 per cent of the farmers were changed their cropping pattern and 8.75 per cent of the farmers started growing tree crops. About 5 per cent of the farmers were following soil and water conservation (SWC) practices. Since the millets were mainly grown in dry land areas without adequate rainfall the cultivation could not be carried out as per the established practices thus warranting newer methods and systems. Maize has become an important substitute crop for traditional dry land crops such as cotton, sorghum and pearl millet in some of the districts such as Dindigul and Perambalur in view of good market potential and higher income.

Determinants of Farmers' Choice of Adaptation Methods - Multinomial logit Model (MNL)

The dependent variable in the empirical estimation is the choice of an adaptation option from the set of adaptation measures listed below;

1. Change in variety

2. Change in cropping pattern
3. Change in sowing dates
4. Mixed/Inter cropping
5. Growing tree crops
6. Soil and Water Conservation Practices
7. No adaptation

The estimation of the multinomial logit model for this study was undertaken by normalizing one category, which is normally referred to as the ''reference state,'' or the ''base category.'' Since change in sowing dates was adapted by more number of farmers it was takes as the base category.

The chi-square value of 344.37 shows that likelihood ratio statistics highly significant ($p<0.0001$) suggesting the model has a strong explanatory power. The pseudo-R square was 0.43 indicating that the explanatory variables explained about 43 per cent of the variation in choice of adaptation strategies. The parameter estimates (table 4) of the multinomial logit model provide only the direction of the effect of the independent variables on the dependent variable. The marginal effects from the multinomial logit model, which measure the expected change in probability of a particular choice being made with respect to a unit change in the independent variables, are presented in Table 5.

It could be observed from Table 5 that education of the farmer increased the probability of adapting to climate change. Education significantly increases change in variety, change in cropping pattern and mixed farming as an adaptation method. A unit increase in the number of years of schooling would result in a 6.0 per cent, 3.4 per cent and 12.2 per cent increase in the probability of change in variety, change in cropping pattern and mixed farming to adapt to climate change. The farm size of the households had a positive and significant impact on mixed / inters cropping adaptation strategy. Large farms have higher possibilities to go for mixed farming/inter cropping. Length of farming experience also affects the adaptation to climate change. A one unit increase in farming experience resulted in 2.9 per cent increase in the probability of changing the sowing dates and 0.3 per cent increase in the probability of changing the cropping pattern as the adaptation strategy. The farm income as well as the non-farm income of the farms surveyed had a positive and significant impact on growing tree crops and soil and water conservation practices.

Farms with higher annual maximum temperature over the survey period were more likely to adapt to climate change through the adoption of different practices. A unit increase in maximum temperature resulted in 6.7 per cent increase in the probability of changing the varieties and 5.6 per cent increase in the probability of changing the cropping pattern. The result of this analysis also shows that increase rainfall significantly reduced the likelihood of using certain adaptation strategies, but increased the probability of changing the sowing dates to adapt to the climate change. Majority of the millet farmers in the study area were adopting this strategy to adapt to climate change.

SUMMARY AND CONCLUSION

The study analyzed the changing pattern of climatic variables especially rainfall and temperature in selected districts of Tamil Nadu and the farmers' perception and adaptation strategies followed by millet growing farmers. Majority of the farmers perceived irregularity and decrease in rainfall, and an increase in temperature. Farmers' perceptions were found to be in broad congruity with the changing dimensions of climatic variables. In terms of adaptation strategies, most of the farmers were found to change the sowing dates and varieties in order to adapt to changing climatic conditions. Mixed cropping was also reported to be an important adaptation strategy followed by the farmers to adapt the changing climate. The results from the multinomial logit model on factors affecting the farmers' choice of adaptation strategies indicate that most of the variables used in the model significantly influenced the choice of a technique. The results of the model revealed that the farmers' education, farming experience, farm size and perceived changes in climatic variables have significantly influenced the farmers' adaptation strategies. Educating the farmers about the impacts of climate change would help them identify appropriate strategies to suit their specific farm conditions and constraints.

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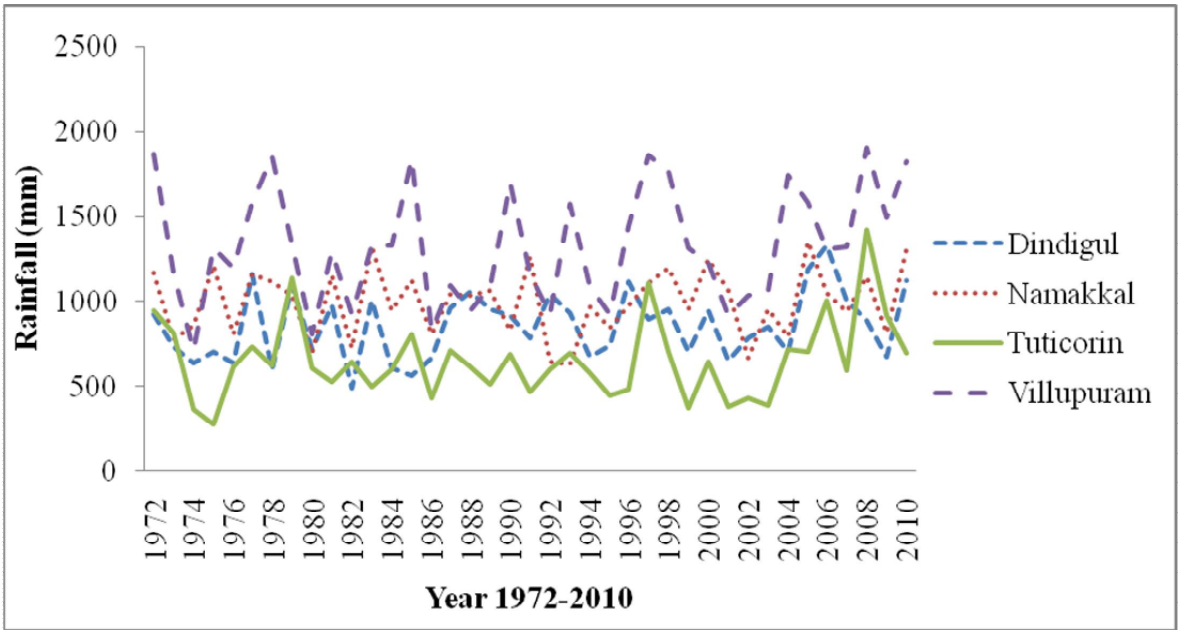

Figure 1 Pattern of Total Annual Rainfall (mm) in selected Districts

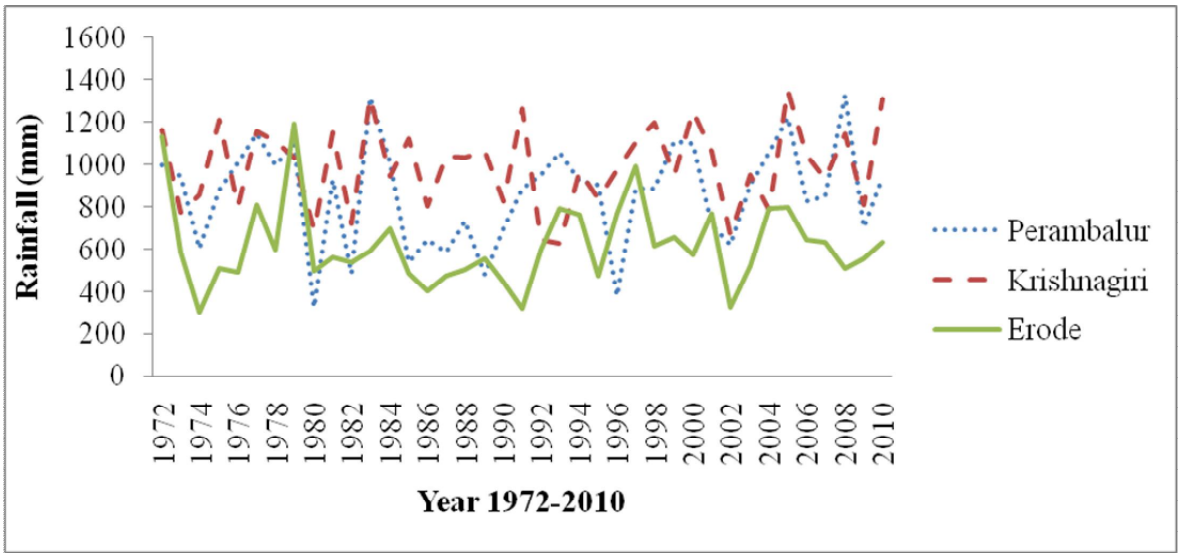

Figure 2. Pattern of Total Annual Rainfall (mm) in selected Districts.

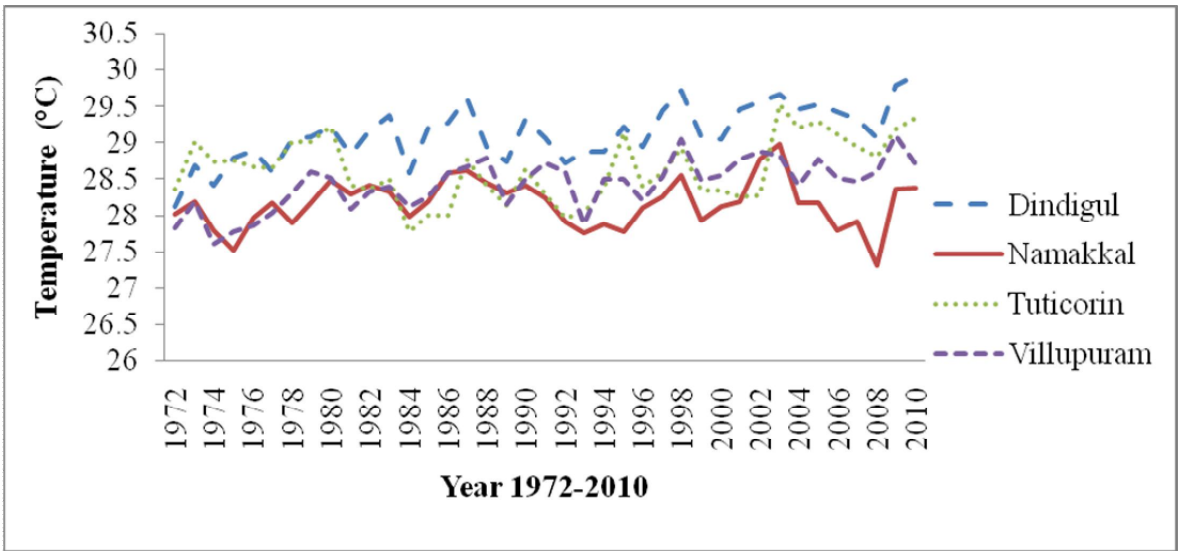

Figure 3 Variation in Mean Temperature (°Celsius) in selected Districts

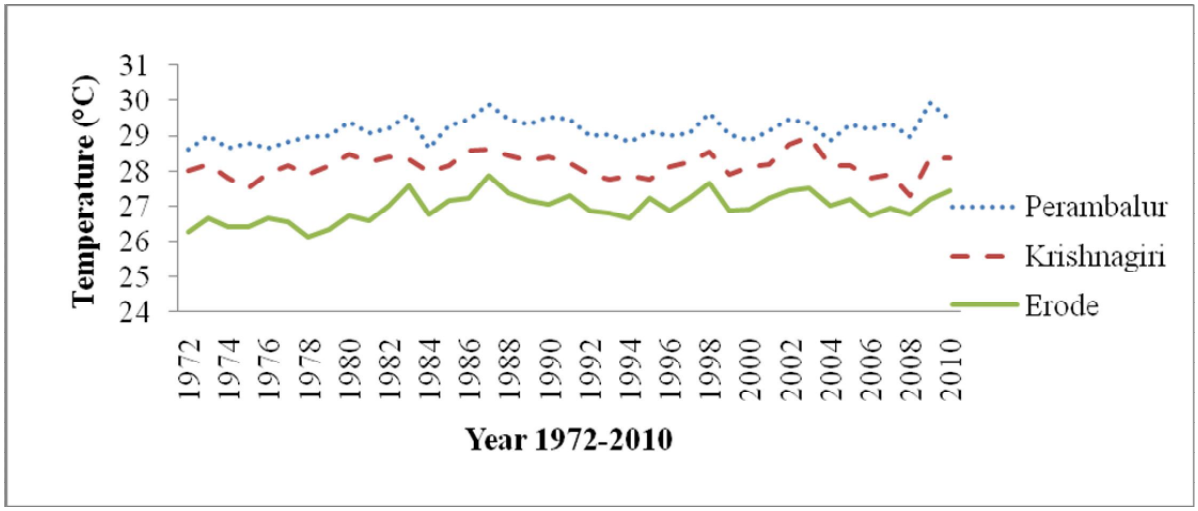

Figure 4 Variation in Mean Temperature (°Celsius) in selected Districts

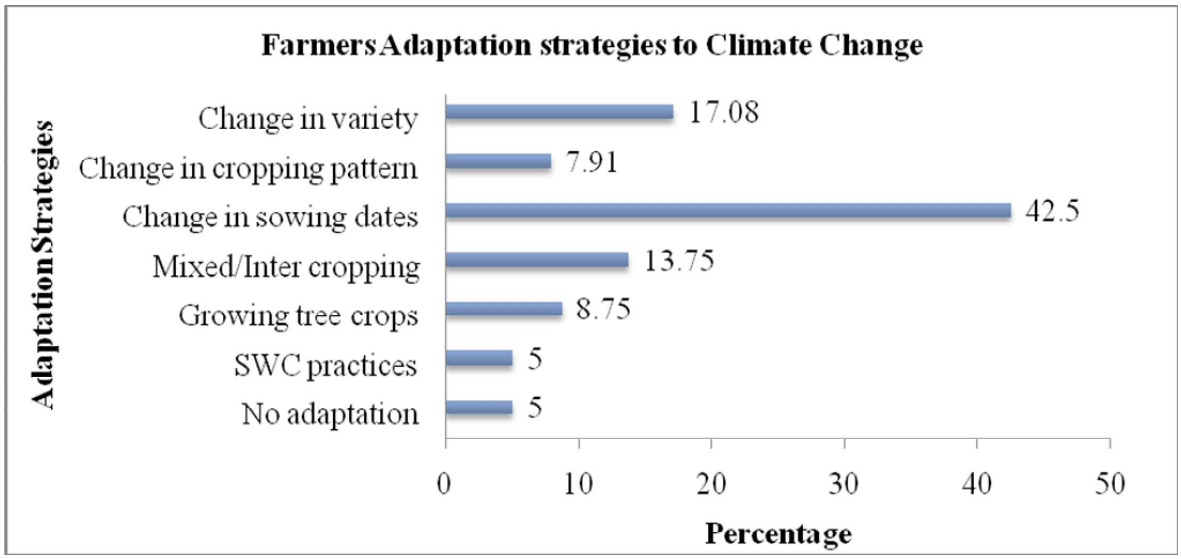

Figure 5. Farmers' Adaptation Strategies to Climate Change in Millet Cultivation

Table 1. Coefficient of Variation in Climatic Variables

S. No	Districts	Coefficient of Variation (%) (Temperature)	Coefficient of Variation (%) (Rainfall)
1.	Dindigul	1.35	23.24
2.	Erode	1.50	31.43
3.	Krishnagiri	1.18	26.25
4.	Namakkal	1.18	26.25
5.	Perambalur	1.12	28.26
6.	Tuticorin	1.53	35.80
7.	Villupuram	1.24	26.16

Table. 2 Farmers' Perception on Climatic Factors (Rainfall and Temperature) n=240

S.No	Attributes	No. of respondents reporting	Percentage to total
I.	**Rainfall**		
a.	Irregular rainfall	84	35.00
b.	Increase in rainfall	13	5.41
c.	Decrease in rainfall	205	85.41
d.	Earlier on – set of rainfall	10	4.16
e.	Delayed on –set of rainfall	43	17.91
f.	No idea	3	1.25
II.	**Temperature**		
a.	Increase in temperature	188	78.33
.b.	Decrease in temperature	11	4.58
c.	Normal	38	15.83
d.	No idea	3	1.25

Table. 3 Description of variables

S. No.	Explanatory variables	Mean	S.D.	Description
1.	Farm size	2.09	1.90	Continuous
2.	Education	2.68	1.40	Continuous
3.	Experience	20.15	10.33	Continuous
4.	Farm income	82286.98	68895.96	Continuous
5.	Non-farm Income	4070.83	10128.83	Continuous
6.	Training/Extension	0.19	0.39	Dummy takes the value of 1 if there is and 0 otherwise
7.	Information about climate	0.20	0.40	Dummy takes the value of 1 if there is and 0 otherwise
8.	Credit facilities	0.204	0.32	Dummy takes the value of 1 if there is and 0 otherwise
9	Temperature	33.54	1.53	Continuous, annual maximum 2012-13 over survey period
10	Rainfall	322.43	103.04	Continuous, annual total 2012-13 over survey period

Table. 4 Parameter estimates of the Multinomial logit model

S.No.	Explanatory variables	Change in variety		Change in cropping pattern		Mixed / Inter cropping	
		Coefficients	P level	Coefficients	P level	Coefficients	P level
1.	Farm size	-.0099	0.77	0.646**	0.044	0.833***	0.002
2.	Education	0.8972***	0.001	1.258***	0.000	1.022***	*0.000*
3.	Farming experience	-0.135***	0.000	-0.137***	0.001	-0.132***	0.000
4.	Farm income	-8.38e-06	0.253	-7.02e-06	0.456	-2.71e-06	0.687
5.	Non-farm income	-0.00001	0.704	-0.00002	0.614	-0.00002	0.562
6.	Training/ Extension	1.004	0.221	0.193	0.848	-0.216	0.809
7.	Information about climate	2.0682***	0.005	-0.887	0.411	-0.091	0.905
8.	Credit facilities	0.315	0.734	1.048	0.298	0.292	0.727
9.	Temperature	0.776***	0.001	1.585***	0.000	0.244	0.247
10.	Rainfall	-0.01***	0.000	-0.007***	0.041	-0.0058*	0.079
11.	Constant	-22.705	0.003	-54.622	0.000	-8.749	0.212

S.No	Explanatory variables	Growing tree crops		SWC practices		No adaptation	
		Coefficients	P level	Coefficients		Coefficients	P level
1.	Farm size	-0.01	0.958	0.040	0.894	0.485	0.169
2.	Education	0.527	0.127	0.806**	0.023	-1.420**	0.034
3.	Farming experience	-0.064	0.155	-0.073	0.103	0.218***	0.006
4.	Farm income	0.00002***	0.000	0.00002***	0.001	-9.60e-06	0.367
5.	Non-farm income	0.0001*	0.000	0.00008*	0.066	0.00004	0.477
6.	Training/Extension	-1.634	0.142	-0.797	0.492	2.550**	0.042
7.	Information about climate	-0.324	0.75	-1.224	0.306	1.319	0.254
8.	Credit facilities	-0.292	0.791	0.292	0.797	-0.315	0.773
9.	Temperature	0.606**	0.036	0.373	0.158	0.628**	0.039
10.	Rainfall	-0.006*	0.087	-0.009**	0.031	-0.001	0.631
11.	Constant	-23.124	0.028	-14.236	0.133	-27.273	0.02

**,* Significant at 1%, 5%, and 10% probability level, respectively

Diagnostics	
Base category	Change in sowing dates
Number of observation	240
Prob > chi square	0.000
Log likelihood	-224.26
LR Chi square	344.37
Pseudo R^2	0.43

Table. 5 Marginal effects from the Multinomial logit Climate Change Adaptation Model

S. No.	Explanatory variables	Change in variety		Change in cropping pattern		Change in sowing dates		Mixed / Inter Cropping	
		Coefficients	P level	Coefficients	P level	Coefficients	P level	Coefficients	P level
1.	Farm size	-0.037	0.259	0.019	0.177	-0.092*	0089	0.128***	0.001
2.	Education	0.060**	0.034	0.034*	0.08	-0.228***	0.000	0.122***	0.004
3.	Farming experience	-0.010***	0.004	0.003*	0.087	0.029***	0.000	-0.14***	0.001
4.	Farm income	1.24e-06	0.11	-3.37e-07	0.363	-4.23e-07	0.746	-6.94e-06	0.455
5.	Non-farm income	-2.90e-06	0.501	-1.28e-06	0.472	-2.21e-06	0.799	-5.83e-06	0.303
6.	Training/Extension	0.164	0.176	0.004	0.893	0.039	0.822	-0.052	0.595
7.	Information about climate	0.380***	0.002	-0.037	0.171	-0.174	0.224	-0.079	0.303
8.	Credit facilities	0.019	0.85	0.053	0.45	-0.083	0.619	0.023	0.842
9.	Temperature	0.067***	0.005	0.056***	0.008	-0.141***	0.001	-0.006	0.839
10.	Rainfall	-0.001***	0.003	-0.0001	0.405	0.0020***	0.002	-0.0003	0.448

(continued….)

S. No.	Explanatory variables	Growing tree crops		SWC Practices		No adaptation	
		Coefficients	P level	Coefficients	P level	Coefficients	P level
1.	Farm size	-0.009	0.368	-0.087	0.562	0.0009	0.525
2.	Education	0.004	0.789	0.022	0.274	-0.005	0.342
3.	Farming experience	-0.0003	0.851	-0.001	-0.677	0.0008	0.352
4.	Farm income	1.34e-06***	0.008	1.38e-06***	0.04	-3.35e-08	0.515
5.	Non-farm income	7.37e-06*	0.013	4.73e-06*	0.07	1.20e-07	0.443
6.	Training/Extension	-0.0558*	0.051	-0.041*	0.276	0.020	0.598
7.	Information about climate	-0.027	0.377	-0.064	0.081	0.003	0.426

8.	Credit facilities	-0.019	0.549	0.007	0.907	-0.001	0.587
9.	Temperature	0.0164	0.188	0.006	0.665	0.001	0.443
10.	Rainfall	-0.0001	0.473	-0.0003	0.193	6.96e-06	0.615

***, **,* Significant at 1%, 5%, and 10% probability level, respectively

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RESEARCH ARTICLE

The Effects of Advertising on Profitability of Industries in Iran (A case study of Cosmetics and HygieneProducts Stores)

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ABSTRACT

Higher sales and profits are among main goals of every business. There are different ways to accomplish such goals such as advertising. Advertisinghas not only a positive effect on profitability, but it can also transform a luxury product into a necessity; therefore, the more advertising there is and the more complementary information accompany a product, the more rational and permanent this transformation would be. This study was carried out using Autoregressive Distributed Lag model with the aim of analyzing the effects of advertising intensity on profitability in cosmetics and hygiene products stores. Our data was based on seasonal figures of 1375-1386(Hijri) and the results showed a significant positive relationship between intensity of advertising and profitability of the mentioned businesses. The same relationship was also present between concentration ratio and profitability.

Keywords: advertising, profitability, market concentration level, autoregressive distributed lag modeling

INTRODUCTION:

In order to maximize their profit, manufacturers advertise their products. According to behaviorism school of thought, behavior patterns of the firms play an important role in the market performance. Therefore, the structure has no or little effect on the market performance whereas firms' behavior is an essential and determining element. Based on the behaviorism views, mere concentrated structure does not necessarily lead to monopoly. But occurrence of such monopoly depends on the mutual conduct of the firms toward each other. It means that collusion leads to

monopoly and absence of that creates competitive performance.Advertising – as a behavioral aspect of the market – can replace or complement various sales-promoting measures. Advertising and sales-promotion costs cannot be described within the framework of perfect competition. The firms whose customers already know about their products and quality, would never be willing to spend on advertising.Advertising would only be effective when the customers lack comprehensive information about products. Chamberlin defines advertising as a factor which affects demand following a change in needs and/or tastes. Schmalensee puts advertising as different ways to introduce ideas, demands and services of a firm. According to Shepherd, advertising is a means to develop customer loyalty toward a particular brand or product. Scitvesky views advertising as a factor that increases profit and decreases price competition among firms. Advertising enjoys a substantial effect on customer awareness and influences their thoughts, feelings, attitudes and decisions (Dehghani and Shahikitash, 1386).Advertising is important not only as a means of communication and competition, but also a means through which customers find out about companies' innovations (Tellis, 2004). Given the importance of advertising in sales and profitability, this study focuses on its effects on firms' sales and profits.The relationship between profitability, as performance variable and advertisingcosts, as behavior variables of the market has been a subject of controversy among economists and different economic schools of thought (Falahi and Dehghani, 1389). On the other hand, several empirical studies emphasizethe need to investigate this subject in Iranian industries.The current study is carried out in the field of cosmetics and hygiene products industry in Iran and seeks answers for the question, whether advertising affects profitability of cosmetics and hygiene products industry.

This study is organized in five parts: part two in dedicated to literature review where we attend to theoretical principles and empirical background of the field. The third part of the article covers the methodology and deals with the model and analytical method that was used. Empirical results are presented in part four and the last part contains conclusion and suggestions for further studies.

Literature review

Theoretical principles

Meriam-Webster dictionary defines advertising as "*something (such as a short film or a written notice) that is shown or presented to the public to help sell a product or to make an announcement."* Advertisingconsists of connection and impersonal introduction of products or services through different carriers in exchange for money in favor of profit/nonprofit organization or persons mentioned in the message (Roustaet.al, 1387). Bakhtaie, in a similar definition, defines advertising as connection and impersonal introduction of products or services through different carriers in exchange for money in favor of profit/nonprofit organizations that is done in order to achieve a specific goal and persuade or convince people (Bakhtaie, 1385).The ultimate goal of commercial advertising, obviously, is to boost and enhance commercial activities which brings to mind trading or trying to create a market for a product. Generally speaking, commercial advertising is a product of capitalism era with its emphasis on consuming a product or a service. Commercial advertising is mostly affected by communication sciences; however, it is occasionally related to sociology, psychology, economics and management (Asadi-tari, 1372).

Advertising originates from literal and intellectual life of human beings, and is an inseparable part of theirlives. Despite the revolution in communication and broadcasting technology, the principles of advertising have remained intact to the extent that promotion of religious beliefs and inviting people into the circle of a religion has taken a different form.

Considering the relationship between advertising and profitability, we can say that in an attempt to maximize their profit, firms would invest in advertising to the extent that expected advertisingcosts are equal to the expected profit. In case the advertiser is banned, firms can try other ways to reach the customers. Since firms prefer advertising over other customer relationship measures, it can be said that advertising is cheaper than other means of customer relationship. The differences between advertisingcosts in different industries clarifythe different nature of goods and

properties of the markets. One assumption is that there is a strong correlation between the type of goods and advertisingcosts in a way that compared to capital goods, consumer goods have higher advertisingcosts. Advertising consumer goods makes more sense because it covers a larger range of recipients. Market of consumer goods is geographically larger and more scattered. Capital goods, on the other hand have a limited number of buyers who need information beyond what advertising can offer. Basically, capital goods buyers are seldom affected by advertising and rather engage in direct negotiations with providers in order to obtain information about quality and properties of the goods (Khodadad kasha, 1389). According to Peter Drucker, the ultimate goal of marketing is to maximize sales. The goal is to help customers know and understand in a way that goods and services sell themselves appropriately. By affecting market concentration ratio, advertising can create monopoly or competition. It can also affect prices through price elasticity of demand. Advertising is capable of changing barriers to market entry which in turn can lead to increased profitability and market share (Azizi&Moghadasi, 1390).*Scholar* suggests two theories on advertising effects. According to his first theory, advertising is a product differentiation factori.e. it can increase profits and decrease consumer welfare through product differentiation. This differentiation seems to be exclusive to imperfect competition markets. The second theory focuses on informative advertising. Based on this theory, advertising leads to a more competitive market where consumers have access to more information. Such a market atmosphere can negatively affects profit (Neokosmidim, 2005).

According to Porter (1974), there are two categories of goods: nondurable and durable. The first category, nondurable goods, are characterized by lower price and higher number of successive purchases e.g. matches or tooth brushes; however, the second-category goods enjoy higher prices and lower number of successive purchases. Porter argues that advertising can affect sales within the first category whereas such effects areconsidered to be minimum on durable goods. Durable consumer goods are usually sophisticated goods whose prices are higher than nondurable goods. Misjudging characteristics of a durable product and purchasing thereof could significantly affect consumer welfare. Therefore consumers need more information than usual, concerning this particular type of goods. In fact, the more sophisticated a product is, consumers would use more information resources like mediato obtain information (Khodadad-kashi, 1389).Consumers tend to look for more information on durable products rather than nondurable ones. Advertising can barely affect durable goods sales. Price competition might be a better way to promote durable goods sales (Keon, 1989). In his study, Keon concluded that median of the advertising/sales ratio for nondurable goods equals 81.3 whereas for durable goods it is as low as 5.18 (Khodadad-kashi, 1389).Keon et al. also found evidence of low advertising intensity for high-price products. According to Nelson (1989), *search goods* are those consumer goods, whose quality is effectively measurable prior to purchase (like books and CDs).*Experience goods*, on the other hand, are products whose quality is only measurable after purchase (like automobile repair services, shampoo and photography films). In case of search goods, advertisinginforms consumers about particular characteristics of the product; however for the experience goods, the goal is to remind consumer of the existence of such products and services. Since advertising is the only way to promote such goods, their advertisingcosts are presumably high. Davis et al. (1991) provide evidence of this assumption. In their study of 300 products in Britain, they concluded that advertising intensity for search goods is %0.4 whereas this values rises to %4 for experience goods. As a behavioral aspect of the market, advertising can replace or complement various sales promotion measures. Advertising and sales promotion costs cannot be described within the framework of perfect competition. The firms whose customers already know about their products and quality, would never be willing to spend on advertising. Advertising would only be effective when customers lack comprehensive information about products.

Level and intensity of advertising varies in different markets. Attempting to analyze such differences, some behaviorist economists focus on structural differences in markets and believe that advertisingcosts can be found within such differences.If we take concentration as an index of structure, the relationship between structure and advertising can be defined based on the relation of concentration and advertising.Cable (1972) believes that there is a second-degree relationship between advertising and level of concentration. This relationship is known as *inverted U theory*. Firms can take various measures in order to maximize their market share. These measures are divided into price and non-price competition categories. Advertising falls into the second category, non-price competition. Taking these measures depends on internal, external and environmental conditions of the firm. Some economists believe that

in an oligopolistic market, advertising is more effective on sales promotion than price competition. Since the level of concentration in an oligopolistic market is higher than a competitive counterpart and lower than a perfect monopolistic one, there is an inverted U relation between concentration and advertising. Therefore the more oligopolistic a market is, the higher advertising intensity it would have and vice versa. The reason forlower advertising intensity in a perfect monopoly is clear: monopolist has monopolized the whole market and sees no reason to promote its market share. Their advertising is limited to notifications and product introductions only (Khodadad-kashi, 1389).

Any price change by a firm in an oligopoly is immediately recognized by competitors and might cause a price war which eventually cuts profit margins of all enterprises. However changing advertising costs would not face immediate reaction of competitors since they do not find it as an immediate threat to their market share. Any reaction to a change of advertising costs of a competitor, requires a significant time span to yield. Thus the advertising intensity is expected to be high in an oligopolistic market. Moreover, profit margin is expected to improve following an increase in concentration. Later on, the firm would advertise to acquire higher shares and dominate the market. Therefore, the highest level of advertising takes place in an oligopolistic market; however, following an increased concentration when firms figure out their interdependencies, they would give up advertising war (Khodadad-kashi, 1389). According to Sutton, medium-concentrated enterprises can enjoy economies of scale; therefore, advertising intensity is expected to be higher in medium-concentrated firms compared to firms with high or low concentration (Sutton, 1974). In most empirical studies, concentration level, product variation and barriers to entry are considered as structural variables, but market performance is reflected in efficiency, technical development, profitability ratio, production and employment rates. Aspects of behavioral variables are reflected in research and development and advertising. Market concentration level could be calculatedby various indexes: N Firm Concentration Ratio, Inverted index of N firms, Herfindhal-Hirshman Index, Hannah-Kay Index and Entropy Index (Khodadad-kashi, 1385, p.99). There are different ideas concerning triple elements of the market. These ideas fall into the framework of the relationship between structural, conduct and performance elements of the market (SCP). However, how these elements are related has long been a subject of controversy among economics schools of thought. Early studies on the triple market elements were conducted by followers of structuralism (Harvard). Mason (1939) was the first to investigate this issue using a descriptive model. Among the triple market elements he emphasizes structure. Introducing the concept of barriers to entry and their effect on conduct and economic performance based on neoclassical model, Bain (1959) confirms the importance of market structure. According to structuralist economists, causal direction of the elements is as follows: *Structure* → *Conduct* → *Performance*. In fact, firm conduct and the decision on collusion or competition is affected by market structure. Structure and conduct of the market participants form market performance and eventually the performance of the whole market and industry. These economists believed that high concentration in a market being dominated by a limited number of sellers, provides a good condition for collusion with the top firms being more willing to cooperate.

Another school of thought, Chicago-U.C.L.A, presents opposing ideas than those of structuralists. It was founded in 1950s and risen to fame by people like Stigler, Demstez, McGee, and Posner in 1970s. Chicago proponents believed in a causal direction from performance to structure and then conduct (P → S → C). According to them, monopoly is a result of superior performance.By lower costs and reduced prices, top firms make their competitors go out of business and simply increase barriers to market entry. Firms and companies who manage to reduce their costs and utilize economies of scale, gain superiority and monopoly over the others. Efficient enterprises enjoy a higher rate of profit due to their lower costs; considering their financial resources, they engage in R&D activities and acquire a higher market share through novel production methods. Due to their low costs, these firms are able to offer so low prices that many of other potential enterprises fail to compete. This situation raise the barriers to enter such a market even higher. Accordingly, the causal direction would be from performance to structure. These economists also believe that social costs of monopoly are compensated with monopoly profits and exercising monopoly power is only possible through collusion. However, this market power fades soon because parties in a collusion constantly try to trick each other and escape the current agreements. Behaviorism, on the other hand, takes behavioral patterns of the

firms as the effective factor in market performance. Accordingly, structure has little or no role in performance, which makes firms' conduct the essential element of performance. According to behaviorism school of thought, mere existence of a concentrated structure does not guarantee monopoly; however, monopoly depends on the interactions between market participants (firms).Thus, if collusion leads to monopoly, lack of collusion results in competition. Firm's decisions in order to enhance quality or change a product, engaging in R&D activities and implementing sales promoting policies, like advertising, are considered as different behavioral aspects of the firms(Khodadad-kashi, 1385, p.17).

Background of the study

Theories of industrial economics have had different applications in economic sectors duringthe recent years. Therehave been numerous studies in this field, among which Leone (1995), Ericson et al. (1992), and Aaker&Keller (2007) have demonstrated the positive effect of advertising on sales and profitability. According to Aaker and Keller, advertising brings brand equity for a firm which leads to higher sales and profitability. Kim (2007) studied the effects of marketing on the reputation and revenue of top American firms which were listed in Fortune magazine; 12 firms out of his sample of 18, presented a significant positive relation between advertising costs and reputation. 14 cases also showed a positive relation between advertising costs and revenue. 5 firms reportedly had a meaningful relation between public relations and advertising costs. Advertising costs and revenue were positively related in 4 firms of the sample. In another study, Kundu(2008) investigated the effect of advertising on profitability (Tobin's Q ratio) and firm value among 172 Indian firms. He concluded that there is a meaningful positive relationship between advertising costs and firm's profitability; however, this relationship is rather estimated to be of low intensity. According to this study -compared to other industries- financial and bank services enjoy a higher effect of advertising on profitability. It is worth mentioning that no significant relationship was found between advertising and firm value. A number of studies were also done on Iranian industries: Azizi and Moghadasi (1390) investigated the effect of advertising intensity on performance in automotive and food industries. Their sample consisted of the annual data of 25 firms (17 food and 8 automotive industries) in Tehran stock market which were extracted from balance sheets and statements (1377-1387). They used unbalanced panel data with a total number of 211 observations. In their study, they investigated the relationship between advertising intensity and three indexes of financial performance, namely return on assets, profit margin, and sales growth. The results showed a meaningful positive relationship between advertising and profit margins in food industries. In the case of automotive industries, advertising intensity was positively related to return on assets, profit margin and sales growth. The combined results of the study confirms that advertising intensity has a meaningful positive effect on performance and profitability of the firms, with automotive firms enjoying a more positive effect compared to food industries. In another work, Khodadad-kashi et al (1391) studied the mutual effects among market structure, innovation and R&D of Iranian factories (1375-1386). They applied simultaneous equations system and two-step least squares method on the combined data obtained from Iranian factories. They concluded that concentration level has significant effects on the level of innovation and R&D among Iranian factories.

They also found an inverted U relationship between concentration level and R&D measures. According to estimation results of advertising equation, increasing market concentration lowers advertising levels, whereas innovative behavior increases advertising levels of the firms. On the other hand, higher profitability caused reductions in R&D measures and level of innovation had no effect on the structure; however, profitability and advertising had a direct effect on concentration level.

MODEL AND METHODOLOGY

According to various schools of thought, elements of market are connected. There have been different studies on concurrency among structural, behavioral and performance elements of the market. Recent studies in the field of industrial economics, utilize different models and methods.These methods include*Vector Autoregressive Model*, *Vector*

Error Correction Model and evaluation of immediate shock effects on other elements within the framework of impulse-response functions and determining long-term cointegrations of the elements. There are three types of variables in simultaneous equations system, namely endogenous, exogenous and predetermined variables. According to Sims (1980), if there is a real concurrency among some variables, this concurrency must be considered the same for all variables and there should not be any difference between endogenous and exogenous variable what so ever (Noferesti, 1387, p.109). Due to concurrency among structural, behavioral and performance variables, they can all be viewed as same and it would not be right to judge them as endogenous or exogenousvariables.Market elements are dependent on self-delayed values, other variables and random elements.

Practically speaking, there can be *k-1* co-integration vectors for *k* variables in a pattern. Long-term relationship among structural, behavioral and performance variables of the market can be examined by *VAR* or *VECM* models. Impulse response function, in this case, represents the reaction of a market element to shocks caused by other structural, behavioral and performance elements through the course of time. The share of each element can also be determinedby variance decomposition. Accordingly, in order to assess the interrelationship among structural, behavioral and performance elements of the market, seasonal data figures of Iranian cosmetics and hygiene products stores during 1375-1386 is as follows:

$$\begin{bmatrix} ADV_{1t} \\ P_{2t} \\ H_{3t} \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} & \beta_{13} \\ \beta_{21} & \beta_{22} & \beta_{23} \\ \beta_{31} & \beta_{32} & \beta_{33} \end{bmatrix} \begin{bmatrix} ADV_{1t\ 1} \\ P_{2t-1} \\ H_{3t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix}$$

Where 'ADV' stands for advertising and indicates all advertising costs. 'P' represents profitability level which indicates profitability/sales ratio. 'H' is concentration level which is measured by Herfindahl-Hisrschmanindex(HHI) – the sum of the squares of the market shares of all the firms.

$$H - \sum_{i-1}^{N} \left(\frac{X_i}{X}\right)^2$$

In the result of this index, each firm's market share is weighted by its own market. Therefore, larger firms are given more weight giving them a superior position in the 'HHI' structure. A time series variable is considered to be stationary if its average, variance and autocorrelation coefficients remain constant over time. Although random shocks might affect a stationary variable for a short time, this effect has no effect over time; therefore, any strategy to alter such variables would be ineffective. There are various tests to check stationarity or non-stationarity, among which *Dicky Fuller Test (DF)* and *Augment Dicky-Fuller (ADF)*are the most common in grading non-stationarity of the series. In a time series analysis, Null hypothesis (H0)states that the series does not have a unit root and is thus stationary. Alternative hypothesis (H1) on the other hand implies that the series has a unit root and is therefore non-stationary. If critical values are smaller than absolute statistic, the series is stationary. Firstly, we apply *ADF* test to test stationarity. We used '*Ewievs8*' to check unit root and stationarity of the intended variables which are listed in table (1-3).

Empirical results analysis

In order to estimate vector auto regressive pattern (VAR), first we need to determine the optimal lag (interval) number. Various data criteria including Final Prediction Error, The Likelihood Ratio, AIC, Schwartz.-Baizain and Hanan-Quinn are utilized. The optimum lag number in the current study – as you can see in table (1-4) - is 2 (appendix B).

Impulse response functions provide useful means to learn about interactions among variables of dynamic patterns. These functions represent the system's dynamic route in response to random shocks in amount of a standard deviation. In other words, these functions represent direction, stationarity, and responses of the endogenous variable of the system to random error shocks. IRFs separate endogenous variable components in response to shocks and then determine the effect of shifting shock level in amount of an SD on current and future endogenous variables. In the current study, IRFs can account for the effect of one standard deviation change in advertising intensity on concentration ratio and profitability. The diagrams bellow reflect the response of advertising variable to random shocks. Figure (1-4) shows diagrams of impulse functions representing variables interactions.

According to the diagrams above, it can be concluded that a positive shock on advertising has a positive effect on profitability and concentration variables.

According to table (2-4), the standard deviation is 0.97, which is moderated to 0.96. It means that %96 of changes in the studied variables are explained through that particular variable which provides a high explanatory power to the model (Appendix C).

In case of a shock imposed on a dependent variable, it will be possible to determine the share of the variable itself and that of other variables i.e. what percentage of variation was caused by the variable and what percentage was caused by other variables being modified. To this end, variance analysis is commonly used the results of which are listed in table (3-4). (Appendix D):

Advertising variable (ADV):

After 10 periods, %17.48 of the variation was caused by the variable itself, whereas profitability and concentration variable respectively cased 50.62 and 31.89 percent variations.
Profitability variable (P):
After 10 periods, %53.90 of the variation was caused by the variable itself, %4.33 by advertising and concentration variable is responsible for %41.75 of the variations.
Concentration level (H):
After 10 periods, %49.64 of the variations were self-cause. Profitability and advertising respectively caused %37.33 and %13.01 variations.

CONCLUSION AND SUGGESTIONS

This study was carried out in order to evaluate the effects of advertising on profitability in cosmetics and hygiene products industries. The results of the study suggest that advertising has a positive effect on profitability. Higher sales and profitability are among main goals of every business. There are different ways to accomplish such goals such as advertising. Advertising has not only a positive effect on profitability, but it can also transform a luxury product into a necessity; therefore, the more advertising there is and the more complementary information accompany a product, the more rational and permanent this transformation would be. Given the positive effect of concentration level on profitability, it is safe to say that higher concentration levels improve profitability is the above said industries. Based on our findings, we can put forward a number of suggestions in order to improve sales in cosmetics and hygiene products industries:

1. Considering the positive effect of advertising on profitability, economic authorities are expected to formulate advertising regulations in order to improve advertising quality and provide more information for the customers.
2. Since advertising in cosmetics and hygiene products industries is not as valued as it should, this market has room for more extensive advertising activities in a way that brings higher profitability to the manufacturers.

3. Marketing managers in these industries can and should transfer marketing ideas to other management levels in a way that they see advertising as an important factor of improving brand recognition and equity and also firm value.

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Table 1: Unit root test results

Result	Level of significance	Critical value	Test statistic	Trend	Intercept	Variable
stationary	%5	-2.93	-0.54	n/a	present	ADV
stationary	%5	-2.93	-1.25	n/a	present	P
stationary	%5	-2.93	-4.07	n/a	present	H

Considering the unit root test, it can be stated that the variables with source width being studied are stationary (appendix A)

Table 2: Determining the optimum lag interval

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-490.1756	NA	1091939.	22.41707	22.53872	22.46219
1	-349.3888	255.9761	2737.064	16.42676	16.91336	16.60722
2	-305.2353	74.25809*	557.4786*	14.82888*	15.68042*	15.14467*
3	-298.4740	10.44936	627.1825	14.93063	16.14713	15.38177
4	-290.6151	11.07386	680.8471	14.98250	16.56394	15.56898

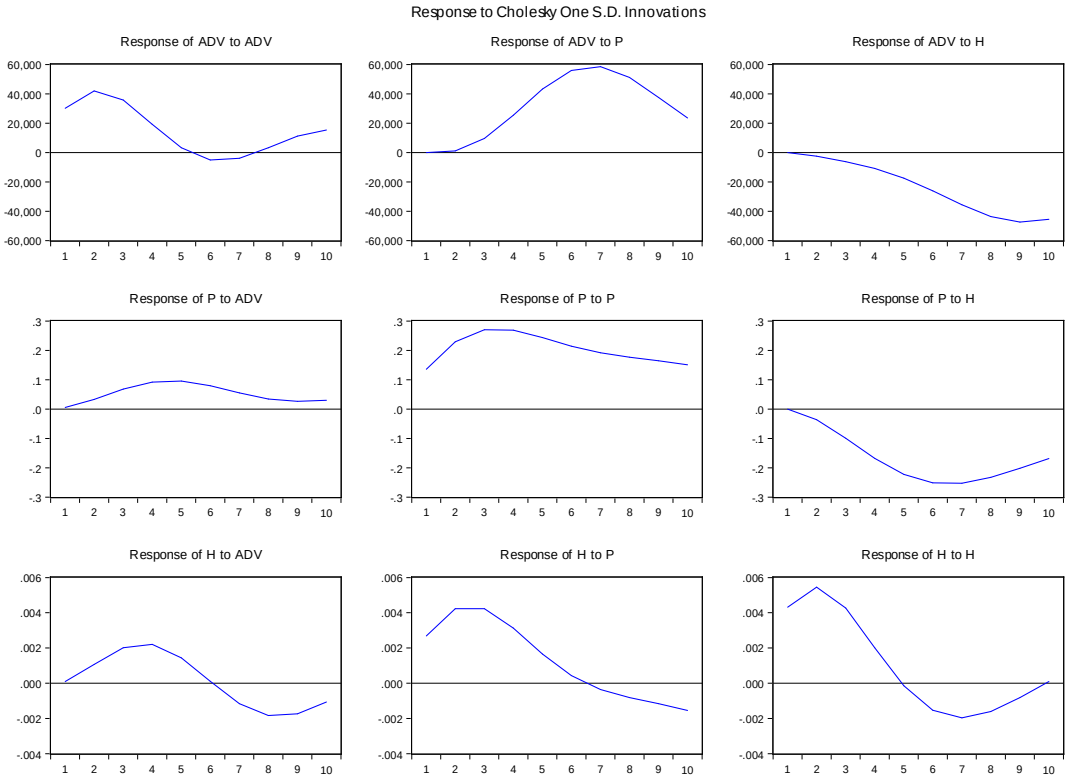

Figure (1-4): Impulse response diagrams

Table 3: Model estimation chart

Vector Autoregression Estimates Sample (adjusted): 1375Q3 1386Q4			
	ADV	**P**	**H**
R-squared	0.973350	0.981470	0.834025
Adj. R-squared	0.969250	0.978619	0.808490

Table 4: Variance analysis results

10 periods	caused by AVD variation	caused by P variation	caused by H variation
ADV variation (%)	17.48	50.62	31.89
P variation (%)	4.33	53.90	41.75
H variation (%)	13.01	37.33	49.64

Appendix A: ADV (variable) stationarity test

Null Hypothesis: ADV has a unit root			
Exogenous: Constant			
Lag Length: 6 (Automatic - based on SIC, maxlag=9)			
			t-Statistic
Augmented Dickey-Fuller test statistic			-0.547561
Test critical values:	1% level		-3.600987
	5% level		-2.935001
	10% level		-2.605836
*MacKinnon (1996) one-sided p-values.			
Augmented Dickey-Fuller Test Equation			
Dependent Variable: D(ADV)			
Method: Least Squares			
Date: 03/13/15 Time: 12:24			
Sample (adjusted): 1376Q4 1386Q4			
Included observations: 41 after adjustments			
Variable	Coefficient	Std. Error	t-Statistic
ADV(-1)	-0.017633	0.032202	-0.547561
D(ADV(-1))	0.909864	0.177050	5.139012
D(ADV(-2))	-0.405219	0.210896	-1.921416
D(ADV(-3))	-0.313072	0.183715	-1.704117
D(ADV(-4))	-1.364934	0.336250	-4.059280
D(ADV(-5))	1.572306	0.458416	3.429866
D(ADV(-6))	-0.762138	0.394962	-1.929647
C	18843.51	9968.953	1.890220
R-squared	0.759270	Mean dependent var	

Adjusted R-squared	0.708207	S.D. dependent var	
S.E. of regression	27246.47	Akaike info criterion	
Sum squared resid	2.45E+10	Schwarz criterion	
Log likelihood	-472.4465	Hannan-Quinn criter.	
F-statistic	14.86904	Durbin-Watson stat	
Prob(F-statistic)	0.000000		

Appendix A: P (variable) stationarity test

Null Hypothesis: P has a unit root				
Exogenous: Constant				
Lag Length: 6 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.256821	0.6403
Test critical values:	1% level		-3.600987	
	5% level		-2.935001	
	10% level		-2.605836	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(P)				
Method: Least Squares				
Date: 03/13/15 Time: 12:25				
Sample (adjusted): 1376Q4 1386Q4				
Included observations: 41 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
P(-1)	-0.029912	0.023800	-1.256821	0.2176
D(P(-1))	0.972348	0.166954	5.824052	0.0000
D(P(-2))	-0.191319	0.204366	-0.936155	0.3560
D(P(-3))	-0.114048	0.172677	-0.660467	0.5135
D(P(-4))	-0.586030	0.174812	-3.352336	0.0020
D(P(-5))	0.752348	0.202725	3.711178	0.0008
D(P(-6))	-0.395782	0.183854	-2.152694	0.0387
C	0.779710	0.599205	1.301242	0.2022
R-squared	0.732190	Mean dependent var		0.034884
Adjusted R-squared	0.675381	S.D. dependent var		0.218230

S.E. of regression	0.124337	Akaike info criterion	-1.158458
Sum squared resid	0.510172	Schwarz criterion	-0.824103
Log likelihood	31.74840	Hannan-Quinn criter.	-1.036704
F-statistic	12.88879	Durbin-Watson stat	2.014126
Prob(F-statistic)	0.000000		

Appendix A: H (variable) stationarity test

Null Hypothesis: H has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.070128	0.0026
Test critical values:	1% level		-3.581152	
	5% level		-2.926622	
	10% level		-2.601424	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(H)				
Method: Least Squares				
Date: 03/13/15 Time: 12:27				
Sample (adjusted): 1375Q3 1386Q4				
Included observations: 46 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
H(-1)	-0.276150	0.067848	-4.070128	0.0002
D(H(-1))	0.643570	0.116885	5.506004	0.0000
C	0.002158	0.000919	2.348266	0.0235
R-squared	0.462407	Mean dependent var		-2.74E-05
Adjusted R-squared	0.437403	S.D. dependent var		0.006746
S.E. of regression	0.005060	Akaike info criterion		-7.671940
Sum squared resid	0.001101	Schwarz criterion		-7.552681
Log likelihood	179.4546	Hannan-Quinn criter.		-7.627265
F-statistic	18.49310	Durbin-Watson stat		1.980311
Prob(F-statistic)	0.000002			

Appendix B: Optimal lag interval

VAR Lag Order Selection Criteria						
Endogenous variables: ADV P H						
Exogenous variables: C						
Date: 03/13/15 Time: 12:42						
Sample: 1375Q1 1386Q4						
Included observations: 44						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-490.1756	NA	1091939.	22.41707	22.53872	22.46219
1	-349.3888	255.9761	2737.064	16.42676	16.91336	16.60722
2	-305.2353	74.25809*	557.4786*	14.82888*	15.68042*	15.14467*
3	-298.4740	10.44936	627.1825	14.93063	16.14713	15.38177
4	-290.6151	11.07386	680.8471	14.98250	16.56394	15.56898
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Appendix C: Pattern estimation results

Vector Autoregression Estimates			
Date: 03/11/15 Time: 15:54			
Sample (adjusted): 1375Q3 1386Q4			
Included observations: 46 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
	ADV	P	H
ADV(-1)	1.393824	7.74E-07	3.05E-08
	(0.14235)	(6.4E-07)	(2.4E-08)
	[9.79187]	[1.20603]	[1.26744]
ADV(-2)	-0.767500	-3.98E-07	-2.40E-08
	(0.13345)	(6.0E-07)	(2.3E-08)
	[-5.75115]	[-0.66252]	[-1.06327]
P(-1)	19590.01	1.859341	0.006157

	(32855.9)	(0.14807)	(0.00555)
	[0.59624]	[12.5569]	[1.10851]
P(-2)	38606.07	-0.967891	-0.008189
	(36448.1)	(0.16426)	(0.00616)
	[1.05921]	[-5.89233]	[-1.32900]
H(-1)	-593354.6	-8.485464	1.263164
	(901851.)	(4.06443)	(0.15247)
	[-0.65793]	[-2.08774]	[8.28489]
H(-2)	306535.0	3.914644	-0.537363
	(917030.)	(4.13284)	(0.15503)
	[0.33427]	[0.94720]	[-3.46614]
C	-1357300.	2.652458	0.050812
	(244076.)	(1.09999)	(0.04126)
	[-5.56097]	[2.41134]	[1.23141]
R-squared	0.973350	0.981470	0.834025
Adj. R-squared	0.969250	0.978619	0.808490
Sum sq. resids	3.53E+10	0.717701	0.001010
S.E. equation	30100.58	0.135656	0.005089
F-statistic	237.4019	344.2827	32.66247
Log likelihood	-535.8401	30.41672	181.4387
Akaike AIC	23.60174	-1.018118	-7.584293
Schwarz SC	23.88002	-0.739847	-7.306021
Mean dependent	292360.1	25.22659	0.007880
S.D. dependent	171653.2	0.927744	0.011628
Determinant resid covariance (dof adj.)		310.4384	
Determinant resid covariance		189.1889	
Log likelihood		-316.3967	
Akaike information criterion		14.66942	
Schwarz criterion		15.50424	

Appendix D: Variance decomposition results

Variance Decomposition of ADV:				
Period	S.E.	ADV	P	H
1	30100.58	100.0000	0.000000	0.000000
2	51756.38	99.71300	0.041867	0.245128
3	63898.94	96.65372	2.243239	1.103042
4	72228.06	82.76087	14.09766	3.141468
5	86015.66	58.49108	35.17364	6.335278
6	105958.2	38.78060	50.96861	10.25078
7	126259.8	27.41118	57.39210	15.19672
8	143055.9	21.40435	57.46006	21.13559
9	155696.0	18.58040	54.31112	27.10848
10	164631.9	17.48304	50.62054	31.89642
Variance Decomposition of P:				
Period	S.E.	ADV	P	H
1	0.135656	0.171684	99.82832	0.000000
2	0.270850	1.525585	96.64385	1.830567
3	0.401186	3.542434	89.47175	6.985818
4	0.519385	5.245287	80.10354	14.65117
5	0.622646	5.990934	71.01644	22.99262
6	0.709259	5.868834	63.84702	30.28414
7	0.778816	5.363346	58.99760	35.63905
8	0.832576	4.864329	56.12193	39.01374
9	0.872832	4.515521	54.62242	40.86206
10	0.902207	4.337416	53.90819	41.75439

Variance Decomposition of H:				
Period	S.E.	ADV	P	H
1	0.005089	0.031079	27.94661	72.02231
2	0.008643	1.531915	33.66854	64.79955
3	0.010719	4.528724	37.49741	57.97387
4	0.011558	7.519032	39.57148	52.90948
5	0.011766	8.751834	40.17496	51.07321
6	0.011874	8.600936	39.57503	51.82403
7	0.012097	9.216179	38.21877	52.56505
8	0.012369	11.02700	36.99272	51.98028
9	0.012571	12.58774	36.66531	50.74695
10	0.012711	13.01883	37.33843	49.64274
Cholesky Ordering: ADV P H				

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RESEARCH ARTICLE

The Effect of Financial Repression on Taxability in Iran

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ABSTRACT

The aim of this study is to analyze the effects of financial repression on the performance of tax system in Iran. In order to carry out this task, ten-year seasonal data (1382-1392) were evaluated using the Vector Error Correction Model (VECM).The results showed that financial repression has a significant negative effect on the performance of tax system. On the other hand, it was concluded that government costs have a significant positive effect on the taxing system.

Keywords: Financial repression, government costs, tax revenues, financial growth, vector error correction model

INTRODUCTION

Governments can use different intervention measures to control financial markets: capping interest rates, involvement in bank credit distribution, enforcing laws and regulations to limit capital and current accounts and high rates of legal deposits, can restrict financial markets and lead to negative interest rates. These measures areknown as *financial repression* that refers to policies aimed at channelingfunds from financial system to the government in order to create resources forother particular sectors.

As an important economic variable, financial repression has a significant effect on financial market and other major economic variables (e.g. tax) and thus influences financial growth and development. Financial repression was theorized by Mckinnon and Shaw (1970-1973) which according to the theory of financial development it includes policies aimed at channeling funds from financial system to the government in order to create resources for other particular sectors. Such policies are mostly aimed at government intervention in pricing and allocation of resources through repression of real interest rates.Despite all the criticisms and the problems such policies could cause, many

governments, especially in developing countries, practice financial repression policies under the pretext of increasing investments, economic growth and increasing government revenue. Due to high tax-collection costs in developing countries, governments use financial repression measures to draw income. To this end, governments reduce their debts through imposing lower interest rates on internal debts compared to external debts. Accordingly, the current paper tries to study the effect of financial repression on taxability and investigate the nature of the relationship, if any, between financial repression and government costs/revenues or taxability. We are seeking as answer to the following question:

Is financial repression effective in taxability in Iran?

In this regard, our study is organized in five parts: part two is dedicated to literature review where we attend to the theoretical principles and the empirical background of the subject; the third part covers the methodology, modeling and analytical methods; empirical results are dealt with in the fourth part and the final part includes conclusions and suggestions for further studies.

Literature review

Theoretical principles

Most of the economic systems during the 50s-60s were influenced by economists who believed in financial repression. Financial repression is characterized by “regulations” that lead to price variance within financial markets. These regulations include nominal interest rate of deposits, interest rate ceiling, highreserve requirements for banks, and credit allocation orders. Any obstacle in enforcing these restrictions, reduces the cash flow to the financial segment. Moreover, resources will be allocated to low performance projects which were not selected in accordance with economic priorities (Ahmadian & Amiri, 1390, p 112). Governments intervene in financial markets through limiting interest rate ceiling, employing high reserve requirements, and implementing guided credit plans; however in practice, financial systems are said to be financially repressed when they face negative real interest rates, high reserve requirement rates and high inflation (Taghavi & Khalili Iraqi, 1383, p 94). Additionally, imposing financial repression leads to poor performance of the taxation system and the more repression there is, the less tax revenues there will be. Classic advocates of financial repression including Mckinnon and Shaw (1973), constructionists of the 80s and 90s, along with post Keynesian school of thought (1992) form the theoretical basis of the financial repression (Taghavi & Khalili Iraqi, 1384, p 94).

Violent repression proponents believe that low or negative real interest rates - which are caused by lowered interest rates (artificial repression) and high inflation rates – prevent formation of savings and have their own negative effects on the growth of accumulation and revenues. It was first proposed by Mckinnon and Shaw, whose names are associated with violent repression, that pressuring financial organizations to pay low or usually negative interest rates (financial repression) puts pressure on savings of the private sector and limits financing measures. By keeping interest rates lower than their natural rates, financial repression reduces savings. In case of any investments, financial growth would be lower than its potential. Such an outlook enables developing countries to improve their domestic savings and reduce dependencies on foreign capital flows (Mckinnon, 1973). This theory was formed due to government interventions in financial markets and investment policies in order to direct resources toward particular financial activities, as being practiced in most of the developing countries.

According to constructionists, low interest rates in developing countries are due to lack or deficiency of appropriate financial markets. They believe that such deficiencies cause serious preventive problems in developing or less-developed countries. From a constructionist point of view, the extended network of financial organizations, distributed financial instruments and development of these organizations enhance saving process, investment and eventually financial growth. The theory of financial constructionism was first proposed by Gerschenkornon the basis of a historic interpretation of the financial role of banks during early years of European industrialization. He

concluded that banks play a more significant role in moderately backward countries compared to severely backward and least backward countries (Tamimi, 2002, p2).

Post Keynesians challenged financial liberalization pattern and proposed a Keynesian alternative. Financial liberalization pattern is based on lendable resources in which saving and investment are determined independently; however, interest rates even them out. In a financial liberalization pattern, as being practiced in developing countries, it is supposed that liberalization occurs upon deregulation and increasing interest rates; however, both of these measures are questioned by post Keynesians. Generally speaking, post Keynesian theory challenges the theory of lendable resources and states that the investment burden in less developed countries is rather on banks than the savers. The theory of lendable resources, which links the opening of credit to forced saving and miscellaneous forms of unbalances, is valid when the assumption is on full employment; as a result, the growth in full employment point is not due to inflatable credits (Taghavi & Khalili Iraqi, 1384, p 96).

Giovannini & Demelo (1993)1, consider the financial repression as a policy based on a combination of limitations imposed on the domestic financial sector and controlling international capital flow to artificially decrease the cost of domestic financing and an income source for the government. This policy is highly appreciated by the governments that face with an effective rate of income taxes because under these circumstances the governments can decrease the tax rates and resource limitations by forcing the people and the banks to keep the government's debt papers by an interest rate lower than what exists in the market. In addition, Richard Frye (1974)2 believes that the government is able to indirectly get loans from the banks with zero costs by setting legal deposit rates, and it also can directly get loans from the banking system by imposing portfolio limitations with high liquidity rates and forcing the banks to keep the government's insurances as the only legal property for their resources.
By proving the positive correlation between budget deficit periods, financial growth, and inflation rate,Sargent and Wallace (1981)3 state that a government whose tax revenue growth is less than its expenses, turns some of its debtsinto money. Economic growth has an indisputable role in the welfare of a society, and more physical and human investments and presenting new production methods and technologies in this regard, are the basics of development process. Due to their effects on the output of physical and human investments, taxes can influence economic decision makings and growth. Different ways from which the government is able make money through financial repression can be summarized as follow:

1. Through maintaining low interest rates, the government will decrease its interest payments.
2. The government can directly get loans from the banking system by imposing portfolio limitations with high liquidity rates and forcing the banks to keep the government's insurances as the only legal property for their resources.
3. Avoiding high expenses of tax demands through common legal methods
4. By maintaining low interest rate on domestic debts than foreign debts, the governments can make a profit to the extent of the difference between the two interest rates.
5. Avoiding the costs related to major structural changes in the country's tax system to increase the income through legal ways a tax demand (Darvishi, 2006).

*Taxation*is an Arabic word, which in Persian is referred to as tribute, altitude, and product. It is the plural form of "maliyeh," meaning what belongs to possessions and properties (Hooman, 1977). Jafari Langroodi (1989) states that taxation is the portion, which according to the principles of national cooperation and regulations, every citizen has to from their wealth and income to the government to spend onpublic expenses and securing economic, political, and social interests. It must be noted that the important thing in defining taxation is the government's authority (without considering its legitimacy) in enacting a law by which people are required to pay their taxes. The most significant issue in a taxation system is the rules and regulations of that system that set the boundaries and the basis for its execution. These rules and regulations define the purpose of taxation, tax base, prices, tax exemption, and the duties

of each tax unit regarding the taxpayers. On the other hand, different economic systems have their own taxation systems. For instance, in Capitalism, levying taxes is based on the principles that exist in Capitalism, and in Islamic economy, Khums and Zakat are the major parts of tax income. In a command and closed economy, a taxation system related to that economy will be defined.

Adam Smith 1 was the most prominent classical economist. Therefore, his four principles are considered to be the main principles in in classical school. In his view, the first principle is justice and equality. According to this principle, the taxes ought to be fairly divided among the people, and it also depends on the financial capability of the taxpayer. He considers proportional tax as a fair tax. His second principle is defining and specifying the taxes. Based on this principle the prices, basis, time of payment and payment method need to be exactly defined. The third principle is simplicity. According to this principle, people's satisfaction and various payment methods are taken into account, and paying taxes should put the least burden on taxpayers. The final principle is referred to as thrift. Based on this principle, economical measures need to be taken into consideration in levying taxes to reduce the expenses.
Keynesians believe in some principles regarding the taxes. The first principle is to personalize the taxation, meaning to consider the earnings and social situation of the taxpayer while defining and imposing the taxes. For instance, the earning from a job is different from the earning from the capital. Since the former make money through physical and mental efforts, they go through a lot more suffering compared to the latter. Therefore, they need to make more sacrifices when paying taxes. According to this principle, the working and social conditions of the taxpayer should be taken into account. The second principle is Interference, in which Keynes and his followers believe that the government should give advices in social and economic activities and the taxes should not be neutral. For example, the government should adopt tight monetary policies to battle against inflation and reduce it by increasing tax rate. The third principle is income desirability, which states that the ultimate desirability of each unit of money or income for low-income people is more than the ultimate desirability of money or income for high-income earners. Therefore, if tax imposed on them is equal in relation to their income, low-income earners would lose more desirability, and this is not fair. In order to solve this issue, progressive taxes should be imposed.

With the development of Information Technology and the movement of command economies toward global economies, taxes have undergone changes. They have become one the main pillars of election systems and apart from economic effects, they have found social, political, and informational characteristics.Although the principles mentioned in classic statements and Keynes' theory still exist and a great number of taxation systems have adapted to them, some new principles have been added to the previous taxation principles according to modern requirements, international relations, and the problems that we face in the implementation of a taxation system. The first principle is to identify the expense areas, in which where and how the taxes are spent are identified to the taxpayers. This principle has a significant distributive factor within itself that accepts people's supervision and leads the taxes toward reducing inequality. The second principle is the simplicity of volunteer tax compliance which monitors the executive and operational methods. The quality of taxation system affects the investment, the development of the private section, and the function of taxation. The taxation system should move toward a direction to promote rapid tax compliance and self-declaration. The third principle is partnership. According to this principle, the development of civil organizations and the possession of the majority of national wealth by the private sector have made the legal tax levying impossible without the partnership of civil organizations and general public (Hassani, et al., 2012).

Background

In recent years a lot of research has been carried out overseas on financial repression and its consequent effects on taxation and tax incomes, for instance, Roubini and Martin 1 (1992) can be mentioned. These two researchers investigated the policy of financial repression and the services provided by the financial sector. The results showed that the policy of financial repression decreases the amount of services provided to the whole economy by the financial sector because it is a cheap potential source available for providing state funds that leads to a decrease in the

level of savings and total investment.In addition, countries with inefficient tax system high tax evasion normally tend to increase per capita real money demand by repressing the financial sector and selecting a high rate of money growth. Therefore, financial repression has a direct link with money growth, inflation rate, and the power of currency issuing, but an inverse relationship with economic growth.In another research conducted by Bai, et al. (1999)2, financial repression and the optimized system of tax levying have been investigated, and the role and effect of financial repression resulting from imposing taxes on savings have been examined. They found that when the real effective rate of income tax happens so accidentally, the government's earning through financial repression is more effective than the total individual income tax of developing countries. Moreover, Gupta and Ziramba (2010), studied the relationship between liberalization, bureaucracy, and the general policies based on non-uniform growth resulting from financial repression. They concluded that the increase in corruption and bribery is the consequence of the decisions made by the government, which is accompanied by high level of financial repression and leads to lack of economic development. In (2009), these two researchers studied the relationship between high cost of tax pressure and financial repression based on non-uniform growth and concluded that direct tax increases the cost of tax levying compared to the indirect one. Also, imposing taxes has a direct link to the increase in bank supplies, and indirect tax levying is considered to be a repressive factor. Regarding the studies carried out within the country, investigating the effects of financial repression on taxation or tax revenues is very recent. Sameti (2000) has investigated taxation in Iran, and the early results show that potential tax revenues exist in sections like agriculture, oil, industry, water, electricity, gas, and mine that are not being taken advantage of. However, considering the effects of taxation on added value of economic sectors, he concluded that our economy is not tax deductible, and in increase in taxes would lead to a decrease in the government's tax revenues. He also added if we get into the components of tax bases, taxes on consumption and sales and income taxes are the only tax bases whose improvement has less diminishing effect on different sections' added value; therefore, their development would increase the government's tax revenues to some extent. In this research, the tax ratio or the ration of the government's earnings to gross domestic product is the main variable. In another research, Darvishi (2006) calculated the government's earning through financial repression during the development program of 1989 to 2004 and concluded that despite the high cost of tax levying, especially in developing countries, financial repression is one of the government's money making tools in these countries. He found that the public sector had earned 80482.380 billion dollars through financial repression, and the government's and state institutions' and organization's share was 65 and 35 percent, respectively.

METHODOLOGY

The variables in this study are as follow:
TR: tax revenue
G: Government's expenses
FR: financial repression whose measurement index is:

$$FR = RR + GOV - RIR - INT$$

In which RR is rate of required supplies, RIR is real interest rate, GOV is bank debts to the government compared to their debts to the private sector, INT is the ratio of liquidity to gross domestic product. In this study, to investigate the effect of financial repression on tax deductibility in Iran, using vector error correction model (VECM) and with the help of seasonal data between 2003 and 2013, the following pattern has been introduced:

$$\begin{bmatrix}\Delta TR\\ \Delta G\\ \Delta FR\end{bmatrix} = \sum \beta_1 \begin{bmatrix}\Delta TR_{t-p}\\ \Delta G_{t-p}\\ \Delta FR_{t-p}\end{bmatrix} + \begin{bmatrix}\alpha_{11} & \alpha_{12}\\ \alpha_{21} & \alpha_{22}\\ \alpha_{31} & \alpha_{32}\end{bmatrix} \begin{bmatrix}\beta_{11} & \beta_{12} & \beta_{13}\\ \beta_{21} & \beta_{22} & \beta_{23}\end{bmatrix} \begin{bmatrix}TR_{t-p}\\ G_{t-p}\\ FR_{t-p}\end{bmatrix} + \begin{bmatrix}U_{TR,t}\\ U_{G,t}\\ U_{FR,t}\end{bmatrix}$$

in which $TR_t$is the country's tax revenue in t season, G is the government's expenses, and $FR$is financial repression. $\Pi = \alpha\beta$in which $\alpha$is the long-term adjustment coefficient matrix and$\beta$is the matrix related to long-run equilibrium conditions.

One of the most important issues in vector regression and vector error correction models is to identify the optimal lag length. In VECM models, considering the number of observations and tests, including normality test, criteria like Final Prediction Error (FPF), Lagrange Coefficient Test (LR), Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC), Hannan Quinn Criterion (HQC), we can identify the optimal lag. In this case, the investigations show that the length of optimal lag is according to the data presented in research 2.

Using traditional and common methods of econometrics in estimating the coefficients of the model applying time series data is based on the assumption that the model variables are stationary. A time series variable is stationary when its average, variance, and autocorrelation coefficients remain stable during the time. The existence of non-stationary variables in the model causes the common T and F tests not to be valid enough and ends up in spurious regressions. Therefore, when encountering time series, the variables are tested from the stationary point of view, and the stable model is estimated. In fact, if a variable is stationary, the shocks given to it would not change the variable's level even in short term. In the long-run, they are totally ineffective on the variable, and the variable would continue its movement around the long-term stable process; therefore, taking actions to change this variable in the long-run would be ineffective. There exist various tests to examine the stability or instability of time series, but the Dickey-Fuller and Augmented Dickey-Fuller test are the most popular tests to identify the level of instable series. In analyzing the time series, the stability or instability are tested with the assumption that H0 does not have a unit root, in other words, it is stable. Also, it is assumed that H1 that has a series of unit root is instable. The statistics' absolute value must be bigger than critical values. If the critical values is smaller than the statistic's absolute value, the series is stable. First, the Augmented Dickey-Fuller Unit Root Test is conducted to examine the stability. In this study, the unit root test is conducted using the Ewievs 8 software, which is shown in Table 3.1.Considering the unit root test, it can be stated that the examined variables are instable (See attachment A). Second, since the variables are instable, their difference is examined. The results in Table 3.2 show that the variables are stable in their first order difference; therefore, the variables are $I(1)$(See attachment B). In this case, the shocks given to the manner of time series have remained stable effects and change the stable process of the variables. In order to identify the kind of model for analysis and estimation, it is required that the model is tested from the co-integration point of view. If the variables in the model are $I(1)$and co-integrated, it would be an appropriate VECM Model.

The analysis ofthe experimental results of research

Joe Hansenco-integrationtest

To determine and test thenumber of co-integrating vectors,a modelin whichlong-termrelationshipincludes theintercept is used. This model, according to themethod proposed byJohansen(1992), is based on the test of entering certainvariablesin the model coincides with determining the rank of long-run equilibriumrelationship matrix. The resultsin Table(4-1) show that at the 0/05 levelthe tracestatisticislessthan the critical value, and is identified as a vector corresponding tothe number ofco-integration vectors. Thissuggeststhe existence ofa long-termrelationshipbetween the variablesofthe model. This quantity of integrated vectors is approvedwith regard to the intercept inlong-termrelationships(Annex C).

There exist severalmethods to determine the co-integratingrelationshipbetweenvariablesof model and extraction of co-integratingvectors. One of the methods of co-integration is the twostagesEngel–Granger Method. This method was doneusingOLS. The Ordinary Least Squares (OLS)does not offer unbiasedestimationof the coefficients due to

neglectingtheshort-termdynamics reactionsbetweenvariables of model.In addition, based on studies byPhillips andDurlauf(1986),OLSis not reliable insmall samples. Therefore,to estimate the long-term relationshipsbetween thevariablesof the model anddynamicanalysisVECMis used. In the systemof simultaneous equationssome of the variablesareEndogenous and some of them are ExogenousorPredetermined. According toSims(1980), if there existsrealsynchronizationbetweena set ofvariables,thatmustbe consideredthe same in allvariables, andthere should be no predefineddiscrimination between endogenousandexogenousvariables (Noferesti, 1999, p. 109). Since there is synchronization among thevariablesstudied, alldatacan beviewedthe same and prejudgmentaboutwhich ofthem areexogenousandwhichareendogenous is not correct. In practice, when variable Kexistsinapattern, the maximum number of linear independentco-integration vector among the variables ofmodelis K-1. In this case,long-termrelationshipbetweenthevariablesstudied could be investigated by theuse of modelsVARorVECM.

Results of the Table(4-2) show thatthe standard deviation(coefficient of determination) isequal to74%and its modifiedfrom is 68% which implies that68% of the change in thevariablesstudied is explainedby this variable it also suggests the appropriateness andthe high explanatory power ofthemodel(seeAppendixd).

Analysis of variance

In order to investigate theinstabilityofvariables,to explain thevariation ofa particularvariable,analysis of varianceshould beperformed(AppendixC). In other words,if a shock enters thedependent variable, it becomes clear what percentageofvariations will be from the variable itself and what percentagewill be from other variables.According to Table(4-3) it can be said that: For tax variable after 10periods, about80/09percent of thevariations is due tothe variableitself, about 13.9percent is because ofgovernment spendingvariable(G) and77/10percent is because offinancialrepression variable (FR) , respectively.

For government expensesvariableafter 10periods,about28/95% of the variations is due tothe variableitself, about 96/3percent is to tax revenue variable(TR)and74/0percent is because offinancialrepressionvariable(FR), respectively.Forfinancialrepressionvariableafter 10periods,about23/28% of the variations is dueto the variable, about60/26% is to tax revenue variable (TR)and15/45% is because of the variable of the government spending(G), respectively.

CONCLUSIONS AND RESEARCHRE COMMENDATIONS

According tothe results of model estimation, it is observed thattax revenue variable has asignificantand negativecoefficient with financialrepressionvariable. Developing countries, at the sametime,are recommended to implement the financial liberalizationpoliciesand alsoreduce financialrepressionin their own countries. Butit is observed, in the real world, thatthe governments of thesecountriessuppressfurtherthe financial system. Thereforethis questionhas alwaysbeen that: what will be theeffect of adopting financialrepression policies on theperformance,growthand othermacroeconomic variables? The positive or negativeimpact offinancialrepressiondepends on thepolitical, economic, and institutionalconditionsineach country alsothe wayit is implemented.

In the case ofthe results of estimationbetween two variables, government expensesandtax revenues, we can see thatthemodelexpressed a significantpositive effectbetweenthese two variables. Thismeans thatthe government canprovide their costsandrevenuesthroughtax system. Thus,according tothe research findings andwith regard to the fact that thefinancialrepression hasnegative effects ontax revenuesand thereforeon economic growth also theperformance ofthe tax systemto improve the country's economicsituationcanbevery important. As a result,due to thefact thatthe tax systemin the countryhas some problemsandinvestigation of the statistics of tax evasionindicates thatthese problems existinthe taxation system. It is recommended that further consideration is given to

theimprovement of the functioning ofthe taxation system, andgovernmentgain their revenues through tax rather thanfinancialrepression.

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Table 1: Unit root test results

Result	Level of significance	Critical value	Test statistic	Trend	Intercept	Variable
Instationary	%5	-2.95	1/67	n/a	present	FR
Instationary	%5	-2.93	-2/90	n/a	present	G
Instationary	%5	-2.93	-1/29	n/a	present	TR

Table 2: Unit root test results

Result	Level of significance	Critical value	Test statistic	Trend	Intercept	Variable
Stationary	%5	-2.95	0/10	n/a	present	FR
Stationary	%5	-2.93	-8/96	n/a	present	G
Stationary	%5	-2.93	-4/31	n/a	present	TR

Table 3: The result of the test of co-integration of variables

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.722909	81.51711	47.85613	0.0000
At most 1	0.252922	27.61394	29.79707	0.0875
At most 2	0.213461	15.36735	15.49471	0.0522
At most 3 *	0.118188	5.282589	3.841466	0.0215
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				

Table 4: relationships estimate

Cointegration Eq	**Coint Eq1**	**Standard error**	**T-Statistics**
TR(-1)	1/000	-	-
G(-1)	0/532472	0/21766	2/44635
FR(-1)	-0/342080	0/08227	-4/15816
C	-154921/5	-	-
R-squared	0/740784		
Adj. R-squared	0/685799		

Table 5: the results of the analysis of variance

10periods	**tax variable**	**government spending variable**	**financialrepressionvariable**
TR variations	80/09	9/13	10/77
G variations	3/93	95/28	0/74
FR variations	26/60	45/15	28/23

Appendixes

Appendix A: TR (variable) stationarity test

Null Hypothesis: TR has a unit root				0
Exogenous: Constant				
Lag Length: 3 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.294941	0.6226
Test critical values:	1% level		-3.605593	
	5% level		-2.936942	
	10% level		-2.606857	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(TR)				
Method: Least Squares				
Date: 03/03/15 Time: 12:50				
Sample (adjusted): 1383Q1 1392Q4				
Included observations: 40 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
TR(-1)	-0.032546	0.025133	-1.294941	0.2038
D(TR(-1))	0.784189	0.187711	4.177640	0.0002
D(TR(-2))	-0.390531	0.231973	-1.683515	0.1012
D(TR(-3))	-0.616390	0.231592	-2.661531	0.0117
C	13421.41	5535.111	2.424777	0.0206
R-squared	0.593103	Mean dependent var		4410.244
Adjusted R-squared	0.546600	S.D. dependent var		21158.77
S.E. of regression	14247.25	Akaike info criterion		22.08298
Sum squared resid	7.10E+09	Schwarz criterion		22.29409
Log likelihood	-436.6597	Hannan-Quinn criter.		22.15932
F-statistic	12.75420	Durbin-Watson stat		1.832476
Prob(F-statistic)	0.000002			

Appendix A: FR (variable) stationarity test

Null Hypothesis: FR has a unit root				
Exogenous: Constant				
Lag Length: 9 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			1.678352	0.9994
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(FR)				
Method: Least Squares				
Date: 03/03/15 Time: 12:41				
Sample (adjusted): 1384Q3 1392Q4				
Included observations: 34 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
FR(-1)	3.885861	2.315283	1.678352	0.1068
D(FR(-1))	-4.281338	2.397857	-1.785485	0.0874
D(FR(-2))	-4.010315	2.449836	-1.636973	0.1152
D(FR(-3))	-2.998979	2.385966	-1.256925	0.2214
D(FR(-4))	-5.142675	2.389967	-2.151777	0.0421
D(FR(-5))	-5.039166	2.520706	-1.999109	0.0575
D(FR(-6))	-5.241515	2.832966	-1.850186	0.0772
D(FR(-7))	-0.583120	2.534961	-0.230031	0.8201
D(FR(-8))	-2.357352	2.861796	-0.823732	0.4186
D(FR(-9))	-10.88466	3.131868	-3.475453	0.0020
C	-268599.1	227892.3	-1.178623	0.2506
R-squared	0.700763	Mean dependent var		14497.09
Adjusted R-squared	0.570660	S.D. dependent var		587070.3
S.E. of regression	384672.3	Akaike info criterion		28.81436
Sum squared resid	3.40E+12	Schwarz criterion		29.30819
Log likelihood	-478.8442	Hannan-Quinn criter.		28.98277
F-statistic	5.386210	Durbin-Watson stat		1.650897
Prob(F-statistic)	0.000413			

Appendix A: G (variable) stationarity test Null Hypothesis: G has a unit root Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.908670	0.0526
Test critical values:	1% level		-3.592462	
	5% level		-2.931404	
	10% level		-2.603944	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(G)				
Method: Least Squares				
Date: 03/03/15 Time: 12:44				
Sample (adjusted): 1382Q2 1392Q4				
Included observations: 43 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
G(-1)	-0.338826	0.116488	-2.908670	0.0058
C	62555.36	39841.00	1.570125	0.1241
R-squared	0.171053	Mean dependent var		3777.683
Adjusted R-squared	0.150835	S.D. dependent var		244335.3
S.E. of regression	225155.4	Akaike info criterion		27.53236
Sum squared resid	2.08E+12	Schwarz criterion		27.61428
Log likelihood	-589.9458	Hannan-Quinn criter.		27.56257
F-statistic	8.460359	Durbin-Watson stat		2.268861
Prob(F-statistic)	0.005837			

Appendix A: G (variable) stationarity test Null Hypothesis: G has a unit root Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.908670	0.0526
Test critical values:	1% level		-3.592462	
	5% level		-2.931404	
	10% level		-2.603944	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(G)				
Method: Least Squares				
Date: 03/03/15 Time: 12:44				
Sample (adjusted): 1382Q2 1392Q4				
Included observations: 43 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
G(-1)	-0.338826	0.116488	-2.908670	0.0058
C	62555.36	39841.00	1.570125	0.1241
R-squared	0.171053	Mean dependent var		3777.683
Adjusted R-squared	0.150835	S.D. dependent var		244335.3
S.E. of regression	225155.4	Akaike info criterion		27.53236
Sum squared resid	2.08E+12	Schwarz criterion		27.61428
Log likelihood	-589.9458	Hannan-Quinn criter.		27.56257
F-statistic	8.460359	Durbin-Watson stat		2.268861
Prob(F-statistic)	0.005837			

Appendix B: TR (variable)Single difference stationarity test

Null Hypothesis: D(TR) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.313286	0.0015
Test critical values:	1% level		-3.605593	
	5% level		-2.936942	
	10% level		-2.606857	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(TR,2)				
Method: Least Squares				
Date: 03/07/15 Time: 18:22				
Sample (adjusted): 1383Q1 1392Q4				
Included observations: 40 after adjustments				

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TR(-1))	-1.305879	0.302757	-4.313286	0.0001
D(TR(-1),2)	1.086396	0.234209	4.638584	0.0000
D(TR(-2),2)	0.650799	0.232216	2.802560	0.0081
C	7535.068	3187.810	2.363713	0.0236

R-squared	0.387264	Mean dependent var	-2406.027
Adjusted R-squared	0.336203	S.D. dependent var	17650.55
S.E. of regression	14380.57	Akaike info criterion	22.07978
Sum squared resid	7.44E+09	Schwarz criterion	22.24867
Log likelihood	-437.5957	Hannan-Quinn criter.	22.14085
F-statistic	7.584291	Durbin-Watson stat	1.805577
Prob(F-statistic)	0.000469		

Appendix B: FR (variable)Single difference stationarity test

Null Hypothesis: D(FR) has a unit root				
Exogenous: Constant				
Lag Length: 9 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			0.103847	0.9612
Test critical values:	1% level		-3.646342	
	5% level		-2.954021	
	10% level		-2.615817	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(FR,2)				
Method: Least Squares				
Date: 03/07/15 Time: 18:15				
Sample (adjusted): 1384Q4 1392Q4				
Included observations: 33 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FR(-1))	0.520734	5.014439	0.103847	0.9182
D(FR(-1),2)	-1.713235	5.018975	-0.341352	0.7361
D(FR(-2),2)	-1.649601	5.118164	-0.322303	0.7503
D(FR(-3),2)	-0.631260	5.086774	-0.124098	0.9024
D(FR(-4),2)	-2.166057	5.092943	-0.425306	0.6747
D(FR(-5),2)	-2.908078	5.043374	-0.576613	0.5701
D(FR(-6),2)	-3.674499	5.466450	-0.672191	0.5085
D(FR(-7),2)	0.573141	5.227351	0.109643	0.9137
D(FR(-8),2)	1.288223	4.169338	0.308975	0.7602
D(FR(-9),2)	-7.797890	3.684312	-2.116512	0.0458
C	73154.73	77246.43	0.947031	0.3539
R-squared	0.894651	Mean dependent var		3647.823
Adjusted R-squared	0.846765	S.D. dependent var		969546.4
S.E. of regression	379531.3	Akaike info criterion		28.79246
Sum squared resid	3.17E+12	Schwarz criterion		29.29130
Log likelihood	-464.0756	Hannan-Quinn criter.		28.96031
F-statistic	18.68296	Durbin-Watson stat		1.994996
Prob(F-statistic)	0.000000			

Appendix B: G (variable)Single difference stationarity test

Null Hypothesis: D(G) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-8.967615	0.0000
Test critical values:	1% level		-3.596616	
	5% level		-2.933158	
	10% level		-2.604867	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(G,2)				
Method: Least Squares				
Date: 03/07/15 Time: 18:17				
Sample (adjusted): 1382Q3 1392Q4				
Included observations: 42 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(G(-1))	-1.336323	0.149017	-8.967615	0.0000
C	4720.915	36386.97	0.129742	0.8974
R-squared	0.667824	Mean dependent var		1509.632
Adjusted R-squared	0.659520	S.D. dependent var		404113.7
S.E. of regression	235803.1	Akaike info criterion		27.62583
Sum squared resid	2.22E+12	Schwarz criterion		27.70858
Log likelihood	-578.1424	Hannan-Quinn criter.		27.65616
F-statistic	80.41812	Durbin-Watson stat		2.046042
Prob(F-statistic)	0.000000			

Appendix C: the result of the test of co-integration of variables

Date: 03/09/15 Time: 14:13				
Sample (adjusted): 1382Q3 1392Q4				
Included observations: 42 after adjustments				
Trend assumption: Linear deterministic trend				
Series: TR FR G R				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.722909	81.51711	47.85613	0.0000
At most 1	0.252922	27.61394	29.79707	0.0875
At most 2	0.213461	15.36735	15.49471	0.0522
At most 3 *	0.118188	5.282589	3.841466	0.0215
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.722909	53.90317	27.58434	0.0000
At most 1	0.252922	12.24659	21.13162	0.5235
At most 2	0.213461	10.08476	14.26460	0.2064
At most 3 *	0.118188	5.282589	3.841466	0.0215
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
TR	FR	G	R	

-4.50E-06	-8.05E-06	2.94E-06	8.80E-05	
-8.13E-06	8.22E-06	8.34E-07	-6.33E-05	
1.22E-05	-2.30E-06	-3.78E-06	2.26E-05	
6.00E-06	-5.90E-07	2.57E-06	2.48E-06	
Unrestricted Adjustment Coefficients (alpha):				
D(TR)	6577.113	-2380.278	-3414.931	-2867.877
D(FR)	-128406.9	-144906.3	-73631.97	67556.07
D(G)	-36341.25	-52949.65	77622.76	-34927.71
D(R)	-24584.11	-17768.11	-10572.99	8243.907
1 Cointegrating Equation(s):		Log likelihood	-2056.434	
Normalized cointegrating coefficients (standard error in parentheses)				
TR	FR	G	R	
1.000000	1.790285	-0.652922	-19.57486	
	(0.25524)	(0.10440)	(2.47705)	
Adjustment coefficients (standard error in parentheses)				
D(TR)	-0.029582			
	(0.00958)			
D(FR)	0.577545			
	(0.29356)			
D(G)	0.163455			
	(0.16786)			
D(R)	0.110574			
	(0.03807)			
2 Cointegrating Equation(s):		Log likelihood	-2050.311	
Normalized cointegrating coefficients (standard error in parentheses)				
TR	FR	G	R	
1.000000	0.000000	-0.301315	-2.090217	
		(0.09914)	(0.37232)	
0.000000	1.000000	-0.196397	-9.766399	
		(0.06201)	(0.23289)	
Adjustment coefficients (standard error in parentheses)				

D(TR)	-0.010240	-0.072526		
	(0.01943)	(0.02407)		
D(FR)	1.755041	-0.157088		
	(0.56316)	(0.69770)		
D(G)	0.593719	-0.142590		
	(0.33678)	(0.41724)		
D(R)	0.254956	0.051913		
	(0.07364)	(0.09123)		
3 Cointegrating Equation(s):		Log likelihood	-2045.268	
Normalized cointegrating coefficients (standard error in parentheses)				
TR	FR	G	R	
1.000000	0.000000	0.000000	-15.99158	
			(4.03279)	
0.000000	1.000000	0.000000	-18.82733	
			(2.35377)	
0.000000	0.000000	1.000000	-46.13569	
			(12.4924)	
Adjustment coefficients (standard error in parentheses)				
D(TR)	-0.051833	-0.064688	0.030224	
	(0.03083)	(0.02362)	(0.00977)	
D(FR)	0.858227	0.011897	-0.219938	
	(0.90951)	(0.69671)	(0.28833)	
D(G)	1.539138	-0.320734	-0.443991	
	(0.51886)	(0.39746)	(0.16449)	
D(R)	0.126180	0.076178	-0.047095	
	(0.11840)	(0.09070)	(0.03753)	

Appendix D: relationships estimate

Vector Error Correction Estimates			
Date: 02/19/15 Time: 16:34			
Sample (adjusted): 1382Q4 1392Q4			
Included observations: 41 after adjustments			
Standard errors in ( ) & t-statistics in [ ]			
Cointegrating Eq:	CointEq1		

TR(-1)	1.000000		
G(-1)	0.532472		
	(0.21766)		
	[2.44635]		
FR(-1)	-0.342080		
	(0.08227)		
	[-4.15816]		
C	-154921.5		
Error Correction:	D(TR)	D(G)	D(FR)
CointEq1	-0.020251	-0.049432	0.997701
	(0.00843)	(0.18211)	(0.29607)
	[-2.40329]	[-0.27143]	[3.36980]
D(TR(-1))	1.236179	-1.248716	-5.994077
	(0.15165)	(3.27754)	(5.32849)
	[8.15158]	[-0.38099]	[-1.12491]
D(TR(-2))	-0.962910	3.351039	-8.377848
	(0.20165)	(4.35819)	(7.08536)
	[-4.77516]	[0.76891]	[-1.18242]
D(G(-1))	0.019345	-0.364123	-1.317146
	(0.00900)	(0.19459)	(0.31636)
	[2.14860]	[-1.87123]	[-4.16349]
D(G(-2))	0.027210	-0.085580	-0.712213
	(0.00962)	(0.20784)	(0.33790)
	[2.82946]	[-0.41176]	[-2.10779]
D(FR(-1))	0.011637	-0.054863	-0.372511
	(0.00450)	(0.09734)	(0.15826)
	[2.58363]	[-0.56360]	[-2.35381]
D(FR(-2))	-0.011910	-0.011666	-0.071777
	(0.00460)	(0.09952)	(0.16179)
	[-2.58653]	[-0.11723]	[-0.44364]
C	3629.790	-12109.13	124567.0

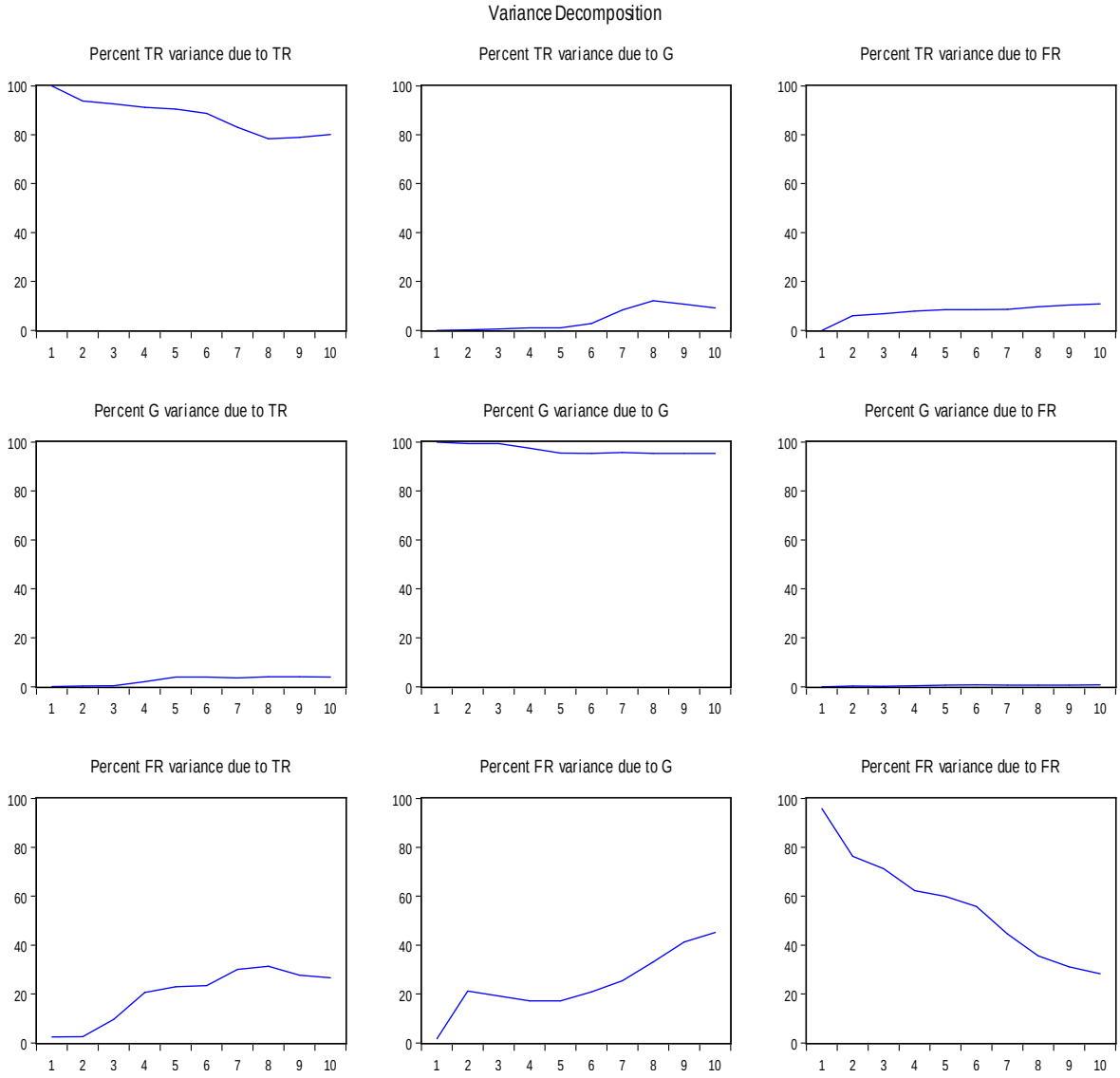
	(2443.86)	(52818.4)	(85869.9)
	[1.48527]	[-0.22926]	[1.45065]
R-squared	0.740784	0.156809	0.508975
Adj. R-squared	0.685799	-0.022050	0.404818
Sum sq. Resids	4.53E+09	2.11E+12	5.59E+12
S.E. equation	11711.30	253112.8	411499.9
F-statistic	13.47243	0.876718	4.886613
Log likelihood	-437.8273	-563.8319	-583.7568
Akaike AIC	21.74768	27.89424	28.86618
Schwarz SC	22.08203	28.22859	29.20054
Mean dependent	4389.937	3929.847	11371.60
S.D. dependent	20893.02	250367.5	533389.8
Determinant resid covariance (dof adj.)		1.43E+30	
Determinant resid covariance		7.44E+29	
Log likelihood		-1584.546	
Akaike information criterion		78.61200	
Schwarz criterion		79.74045	

Appendix E: the results of the analysis of variance

Variance Decomposition of TR:				
Period	S.E.	TR	G	FR
1	11711.30	100.0000	0.000000	0.000000
2	30513.05	93.84741	0.145198	6.007391
3	45241.97	92.65915	0.566171	6.774682
4	50866.67	91.16893	0.990900	7.840171
5	51195.10	90.52854	0.981263	8.490195
6	52193.01	88.73703	2.819326	8.443649
7	53960.29	83.05962	8.326654	8.613727
8	58201.93	78.29597	12.12797	9.576056
9	65990.24	78.92954	10.73675	10.33370
10	71673.83	80.09007	9.135995	10.77393

Variance Decom-position of G:				
Period	S.E.	TR	G	FR
1	253112.8	9.47E-06	99.99999	0.000000
2	298420.4	0.351125	99.38636	0.262514
3	343757.1	0.389070	99.38261	0.228325
4	383998.2	2.071431	97.48859	0.439979
5	420847.2	3.891668	95.49464	0.613693
6	452720.1	3.918490	95.35301	0.728499
7	478082.5	3.603069	95.70554	0.691394
8	498086.1	4.026642	95.32821	0.645147
9	512885.1	4.056277	95.30314	0.640579
10	527313.4	3.962216	95.28925	0.748530
Variance Decom-position of FR:				
Period	S.E.	TR	G	FR
1	411499.9	2.425851	1.728946	95.84520
2	479796.2	2.483255	21.24098	76.27576
3	519377.2	9.581157	19.17584	71.24300
4	556994.5	20.55240	17.15909	62.28851
5	569266.3	22.94035	17.19476	59.86489
6	593878.7	23.41171	20.78839	55.79989
7	675243.1	30.01148	25.44598	44.54254
8	764156.7	31.33057	33.09293	35.57650
9	819943.1	27.68815	41.25132	31.06053
10	859932.8	26.60727	45.15383	28.23890
Cholesky Ordering: TR G FR				

Appendix E: The Results of the Analysis of Variance



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RESEARCH ARTICLE

Consumer Skepticism*:* Revision on Advertising from Behavioral Dimension

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ABSTRACT

According to increasing the number of advertising tools and common loss of trust which is expanding so skepticism to advertising is proposed today. In this paper besides wedescribe theskepticismtowardadvertising, factorsaffectingthemeanings is specified and theconsequences ofskepticismin themarketwill be determined. The articlestated thatfactors such asnegative attitudestowardscorporate social responsibility, flexibilitytonegativeinformation, fairness, oralpropagandawhich included in thecomponentsofskepticismtowardadvertising and Factorssuch as gender, age, advertising content, integrity, andvaluecan beconsideredasinfluencingfactors.

Keywords:skepticism – advertising- Consumer behavioral

INTRODUCTION

Advertising mean is The placement of announcements and persuasive messages in time or space purchased in any of the mass media by business firms, nonprofit organizations, government agencies, and individuals who seek to inform and/ or persuade members of a particular target market or audience about their products, services, organizations, or ideas(www.marketingpower.com) According to financial growth and increasing the number of advertising tools, firms persuade customers to buying products by means of various advertisements and Sincepeoplearebombarded withadvertisingfirmsThis givestheplantaconsumerbuysa productthatdidnotradicallywant and This issomewhatskepticalabout believing it and also makes them skeptical about the valuable information presented in the message of advertisement(Hussain shah & co, 2011).Public thoughttoskepticisms is often a picture far from the truth, and verysimplistic. Such thatskepticismis oftenthoughttobetheonlything itcan do is excuse making and skeptics are likepeople whoare disable to give anyuseful idea and are incapableofthinking and finally the only thing they do is destroying others' thought insight is.if in the contrary of popular belief skepticismand

skepticalthinkingrequirethoughts that farmore active andmoreaggressive. On the other hand with regard to increasing the number of advertising tools and public and peoples' skepticism development towards advertisement, we decided toevaluate the effectivenessof skepticism and factors influencing the advertisements.

Lecture Review

Consumer skepticism

The term skepticism suggests several meanings, and Ford, Smith, and Swasy(1990) called for research into the dimensionality of ad skepticism. One may beskeptical not only of the literal truth of ad claims, but also of the motives of theadvertisers; the value of the information to oneself or society; or the appropriatenessof advertising for specific audiences, such as children, or for specific products, suchas cigarettes or alcohol. Further, the term skepticism may suggest other criticismsof advertising, such as the embodiment of low culture or intrusiveness. Ourdefinition limits us to the consideration of only the first of these meanings-thetendency to regard ad claims as more or less believable. Our use of the wordskepticism and its forms in this discussion is limited to the sense of disbelief. Our construct definition also separatesadskepticism from the more general attitude toward advertising(Obermiller&Spangenberg, 1998).

In general, skepticism refers to a person's tendency to doubt, disbelieve,and question (e.g., Boush, Friestad, & Rose, 1994; Forehand& Grier, 2003). The word “skepticism” comes from the Greek word“skeptomai,” which means to think, to consider, to examine. Skepticismrelates to but is qualitatively different from cynicism, suspicion, (low) trust, and distrust. Specifically, cynicism involves the enduringbelief that people act solely on the basis of their selfish motives andconstitutes a personality trait that is stable across contexts and overtime (Mohr, Eroglu, & Ellen, 1998).

Suspicion refers to the belief that an actor's behavior reflects a motive that the actor wants hidden from the target of his or her behavior(Fein, Hilton, & Miller, 1990). Trust is a positive expectation of apartner's beneficial conduct, while distrust is not just the absence oftrust, but the active expectation that the other party will behave ina way that violates one's welfare and security (Cho, 2006)(Skarmeas&Leonidou, 2013).

Most prior research has conceptualized skepticism as atrait that predisposes individuals to doubt the veracity of variousforms of marketing communication, including advertisingand public relations (Obenniller&Spangenberg, 1998).Although consumers certainly vary in their predisposition towardskepticism, we argue that consumer skepticism is also aproduced by situational variables that direct consumer attentionto the motives of marketers and thereby induce a "state"of skepticism. This attention to the perceived motives of marketers is unusual within research on skepticism (see Ellen,Mohr, & Webb, 2000, for a notable exception). The scant researchthat does exist suggests that consumer skepticism offirm motives (and hence unfavorable evaluation of the firm)occurs when consumers attribute self-serving motives to thefirm (Campbell &Kirmani, 2000; Ellen et al., 2000; Webb &Mohr, 1998).

Herein, we argue that consumer skepticism toward a firmis driven not simply by beliefs that the firm's motives areself-serving but rather by the perception that the firm is beingdeceptive about its true motives. This thesis suggests thatfirms may be able to inhibit the development of consumerskepticism by publicly stating the potential self-serving benefitsof their actions(Forehand & Grier, 2003).

Within consumer research, skepticism has typically beenconceptualized as a stable belief that increases consumerdistrust of marketing communications (Obermiller&Spangenberg, 1998) and creates a negative attitude towardthe motives of marketers (Andrews, 1989; Boush, Friestad,& Rose, 1994; Calfee&Reingold, 1994; Mangleburg&Bristol, 1998). The presumed stability of skepticism has also prompted the development of scales to measure it (Kanter&Wortzel, 1985; Obermiller&Spangenberg, 1998).Although research on trait skepticism provides

importantevidence that consumers can differ in their tendency to becomeskeptical, skepticism may also be localized to specificmarketers or messages(Forehand & Grier, 2003).

Advertising Skepticism:

Skepticism in relation to advertising is not a recent phenomenon; the great Depression of 1930s advertising cameunder the public, political and scholarly scrutiny and coined a term "Consumer Movement"(Calfee&Ringold,1994). It was the era when the emphasis on the 'truth in advertising' caused to form the major regulatory bodiesin the United States for instance Federal Trade Commission (FTC) and Better Business Bureau (BBB) and others,with having the core objectives to promote the truth in advertising through several existing models thenborrowed from 'Printers' ink' versions (Tedlow, 1981, Cite Roland Cole, 1921). Historically, in the same era, J. Walter Thompson (JWT) an advertising agency subsidiary in Bombay and the head office at New York wasengaged with British India government during the WWII and afforded their practices of propaganda within thedomain of advertising (Mazzarella, 2003, p.303). It argues that truth in advertising practices during colonialtimes in India would be considerably on recess due to inadequate rationale of education and awareness(Hussain shah & co, 2011).

Ad skepticism is influential and probabilistic, not uniformly deterministic. **A**highly skeptical consumer may not disbelieve every ad claim, and a less skepticalconsumer may not necessarily believe every ad claim. Rather, the highly skepticalconsumer should be more likely to disbelieve and the less skeptical consumer morelikely to believe. Further, situational factors may moderate responses even withextreme skepticism. Factors such as claim substantiation, source characteristics,prior knowledge, and message variables, which have been shown to influencepersuasion,should play roles in determining acceptance of claims in specificadvertisements(Obermiller&Spangenberg, 1998).

A free market is characterized by easy access to information about goods andservices, but easy access is not enough if consumers do not believe that advertisingclaims are true and useful. It is perhaps paradoxical that the nature of a free marketencourages exaggerations in advertising, which, in turn, may result in consumerskepticism and demands for advertising regulation. The marketplace both toleratesand relies on some level of consumer skepticism. At the same time, its informationvalue is diminished to the extent that consumers are skeptical of advertising'struthfulness and the market is less efficient. The nature and implications **of**consumer skepticism toward advertising are the focus of study here. Considerable criticism has been directed at advertising and business in general,and that criticism has motivated work on scales to measure attitudes toward business(e.g., Barksdale & Darden, 1972), attitudes toward marketing (e.g., Gaski&Etzel,1986), attitudes toward advertising (e.g., Muehling, 1987), and beliefs aboutadvertising (e.g., Andrews, 1989), but no work has been done specific to skepticismtoward advertising. Our intent is to develop a valid scale to measure consumerskepticism toward advertising(Obermiller&Spangenberg, 1998).

We define skepticism towardadvertising in general as the tendency toward disbeliefof advertising claims. We regard skepticism toward advertising in general (alsoreferred to as ad skepticism) as a stable, generalizable marketplace belief, one of the overarching propositions that compose a consumer's implicit theory of how themarketplace operates (Moore-Shay & Lutz, 1988). We refer to advertising in the general sense of paid nonpersonal commercial communication. We expect adskepticism to generalize across media within individuals, although we recognizethat medium may exert a situational influence on skepticism toward a specific ad(Obermiller&Spangenberg, 1998).

Ad skepticism is constrained to advertising. We do not believe that ad skepticismnecessarily reflects a more general tendency not to believe any communications.We conceptualize it as a marketplace belief. Through some set of socialization andconsumerexperiences, consumers may come to believe that advertising can betrusted to some degree. People come to trust other sources of information (politicians,news reporters, etc.) through other sorts of learning(Obermiller&Spangenberg, 1998).

Prior consumer research has found that consumersdraw inferences about marketer motives (Boush et al.,1994; Campbell &Kirmani, 2000; Friestad& Wright,1994) and that attributions of marketer motives impact subsequentevaluations of the firm (Campbell, 1995; Campbell&Kirmani, 2000; Ellen et al., 2000; Forehand, 2000; Webb& Mohr, 1998). Further, individuals have been found to attributetwo primary types of motives to firms: motives thatfocus on the potential benefit to individuals external to thefirm (public-serving) and motives that focus on the potentialbenefit to the firm itself (firm-serving)(Forehand & Grier, 2003).

When consumers attribute marketing actions to firm-servingmotivations, negative reactions to the sponsoring firmsoften ensue (Andreasen, 1996; Drumwright, 1996; Ellen etal., 2000; Gurin, 1987; Webb & Mohr, 1998). Although thiseffect is well documented, the process that produces thesenegative reactions is not completely clear. One explanationof this finding is that consumers use the existence offirm-serving motives as a cue to their attitude toward thefirm. At the heart of this explanation is the belief that consumerswould ideally like to see pure public-serving motivesbehind firm actions and that any deviation from such firm"altruism" is viewed negatively. As a result, any factor thatincreases consumer skepticism of a firm's motives is likely tolead to a relatively less positive reaction.An alternative explanation of the negative relation betweenperceived firm-serving motives and firm evaluation isthat consumers respond negatively to strategies that seem deceptiveor manipulative (Campbell, 1995; Forehand, 2000).Following this explanation, it is not so important whether theconsumer perceives firm-serving motives but rather whetherthe perceived motives are discrepant with the firm's statedmotives(Forehand & Grier, 2003).

Conceptual model in advertising Skepticism

According to researches conducted in this area, we investigated theConstituent elements of advertisement skepticism and factors influencing them are revealed and consequences which this variable may have will be also investigated.

Constituent elements

According to the research conducted four dimensions of skepticism are proposed. Thismodelis derived from thestudyof skarmeasand Leonidou (2013) which its dimensions include social responsibility of firms, flexibility about the negative information , fairness and oral ads which their definition are presented in short.

Cause-related marketing is a type of corporate social responsibility (CSR) initiative. Cause-related marketing ismore prevalent today because CRM is able to enhance corporate image and profits as well as increase funds for a multitude of causes. Cause related marketing has been defined as: “the process of formulating and implementingmarketing activities that are characterized by an offer from firm to contribute a specified amount to a designatedcause when customers engage in revenue-providing exchanges that satisfy organizational and individualobjectives” (Varadarajan& Menon, 1988, p. 60)(Anuar& Mohamad, 2012).

Consumer skepticism is defined as consumers’ tendency to disbelieve or question a company’s motivation toconduct a CRM program (Mohr, Eroglu, & Ellen, 1998). Skepticism toward advertising is the general tendency of disbelief about advertising claims; it represents a basic marketplace belief that varies across persons and isrelated to general persuasability (Obermiller&Spangenberg, 1998, p. 159).In the CRM context, for every CRM campaign conducted, brands or companies often make claims about theirsupport for or involvement in social and environmental issues. These claims can be viewed with skepticism byconsumers. Consumer skepticism can lead consumers to respond negatively to CRM campaigns. In general, a highly skeptical consumer will perceive the accuracy of a CRM claim to be low. In contrast, a consumer with alow level of skepticism will perceive the accuracy of a CRM claim to be higher. Additionally, consumerskepticism toward CRM can increase if CRM campaigns are heavily advertised in the media (Singh et al., 2009)(Anuar& Mohamad, 2012).

An important issue that has arisen in respect of the increasing trend toward socially responsible consumptionamong consumers and the widespread use of CRM in many parts of the world is whether or not consumers viewCRM with skepticism. Consumer skepticism makes consumers doubt or question a company's claims regardingits involvement in trying to improve or mitigate social and environmental issues. Previous studies point out thatin a country where CRM is widely used, such as in the USA, consumer skepticism toward CRM is declining(e.g., Webb & Mohr, 1998). In addition, previous studies suggest that consumers in countries where CRM is lessestablished have a less positive attitude toward CRM (Lavack&Kropp, 2003; Singh et al., 2009). Consumerskepticism toward CRM is a challenge for companies investigating the possibility of implementing CRM. This isbecause CRM tends to be viewed with skepticism because a donation to a particular cause is linked with apurchase of a product (Singh et al., 2009). Thus, consumers often perceive CRM as an exploitation of a cause fora company's self-interest (Cui et al., 2003; Forehand & Grier, 2003). Past research suggests that skepticismaffects consumer response to CRM campaigns (Bronn&Vrioni, 2001; Pirsch et al., 2007; Singh et al., 2009;Webb& Mohr, 1998). Moreover, consumer skepticism could lead to rejection of the CRM claims made in CRMcampaigns (Bronn&Vrioni, 2001) and could affect the purchasing behavior of consumers (Gupta &Pirsch,
2007)(Anuar& Mohamad, 2012).

Resilience to negative information refers to the extent to which consumers do not allownegative information about a company to diminishtheir general view of the company (Bhattacharya & Sen, 2004;Eisingerich, Rubera, Seifert, & Bhardwaj, 2011). Such behavior occurswhen a company has built "a reservoir of goodwill" and consumersexperiencean enhanced fit with the company's identity (Bhattacharya &Sen, 2003). Such behavior does not occur, however, when consumersdoubt the company's reasons for contributing to the well-being of societyand are wary of its ethical standards and social engagement. Here,the negative information consumers receive about the company islargely congruent with their questioning attitudes toward its social involvement,and consumers lack the motivation to support and defendthe company by generating counter-arguments in the face of negativepublicity (Eisingerich et al., 2011).Consequently, consumer skepticism toward CSR can be detrimentalto the development of resilience to negative information(Skarmeas&Leonidou, 2013).

Retailer equity implies that consumers have enduring, favorable associationswith the retailer (Yoo et al., 2000). Consumers who holdstrong positive attitudes toward a retailer likely demonstrate enhancedresistance to negative information about the firm (Dick &Basu, 1994).Attitude-driven message selectivity and cognitive consistency processescan explain this relationship. The former argues that peoplewithcertainperceptions about an object likely engage in selective attention ofinformation to block out any inconsistency with their attitudes (Fazio,1990). The latter reflects people's need to maintain a coherent set ofbeliefs and attitudes about objects to appropriately drive informationprocessing and acceptance (Frey, 1986).Therefore, consumers with strong attachments to a retailer aremore likely to downplay or reject information that runs counter totheir positive attitudes toward the retailer and less likely to acceptsuch information as diagnostic and relevant to their decisions(Ahluwalia, Burnkrant, &Unnava, 2000)(Skarmeas&Leonidou, 2013).

WOM refers to informal, interpersonal communication amongconsumers about their personal thoughts, ideas, or comments abouta company (De Matos & Rossi, 2008). Consumers likely engage inWOMas a form of communicating their positive or negative experiences, feelings,andemotionswith companies in an attempt to exchange diagnosticinformation and improve decision-making quality. Positive WOM occurs when customers have high satisfaction withthe company, experience notable and positive emotional experiences, and have high levels of commitment and loyalty (Skarmeas&Leonidou, 2013).

Influencing Factors

Calfee and Ringold (1994) presented ample empirical evidence suggestingwidespread consumer skepticism toward advertising. Based on a review of allavailable measures of consumer feelings and beliefs about advertising

(mostlypublic opinion polls), the authors concluded that the majority of consumers believethat advertising is often untruthful; that it attempts to persuade people to buy thingsthey do not want; that it should be more strictly regulated; and that, nonetheless, itprovides valuable information(Obermiller&Spangenberg, 1998).

Ford, Smith, and Swasy (1988) reported that 65% ofad claims were either of experience or credence type, indicating that the majority of ad claims are of a type that may be viewed with skepticism(Obermiller&Spangenberg, 1998).

Boush, Friestad,and Rose (1994) found some evidence for increasing skepticism with age amongadolescents. (Theelderly may represent an exception to the model. As age increases,a point may come when analytical abilities begin to diminish and resistance toadvertising decreases.)**(**Obermiller&Spangenberg, 1998**).**

Ford etal. (1990) (hereafter FSS) examined consumer skepticismtoward advertising, making predictions aboutthe impact on skepticism of a variety of product andCorresponding author. Tel. (412) 648-1562; fax: (412) 648-1552.
advertising claim characteristics based on the EOIliterature. Their predictions are based primarily onverifiability: consumers should be least skeptical ofclaims that are the most easily verified(Feick&Gierl, 1996).

Sandage and Leckenby (1980) also developed a scale based on a two-dimensionalconceptualization. It consisted of beliefs about the institution of advertisingand beliefs about its practice. Their scale focused on the evaluative response toadvertising, and only one of the eight items (*honestJdishonest*) appears to be clearlyrelated to skepticism. Some overlap may exist with *worthlessIvaluableordirtyIclean*, but little exists with items such as *weakIstrong* or *dangerousIsafe*(Obermiller&Spangenberg, 1998).

Chaiken andYates (1985) and Wood (1982) found that cognitive structures that are moreinternally consistent or have more relevant information are associated with lesspersuasability. Thus, for our purposes, we assume that consumers' skepticismtoward advertising will not vary by gender but will vary by product type, whichmay have some loose links to gender.

An interesting approach to gender differences in persuasability in the marketplacewas taken by Kanter and Wortzel (1985), who observed that the increasingindependence and responsibility enjoyed by women in the marketplace has alsobeen accompanied by increasing feelings of cynicism. They defined *cynicism* as"the suspicion of other people's motives, faithfulness, and goodwill" (p. 6) andlinked it directly to the believability of advertising claims. Their scale itemsincluded the following beliefs about people: They will lie, they are not honest, theydon't stick to their ethics, they are out for themselves, they only pretend to careabout others, and they dislike sacrificing for others(Obermiller&Spangenberg, 1998).

Consequences

Consumers are skeptical of advertising in the abstract, but they nonetheless extractmuch useful information from ads. This appears to reflect a complex process in whichadvertisers devise means to achieve credibility with rational consumers who understandthe self-interested nature of advertising. (p. 24)TheCalfee and Ringold explanation is that consumers, as a group, recognize theintent and exaggerations of advertisers and discount ad claims accordingly**(**Obermiller&Spangenberg, 1998**).**

Previous studies found that consumer skepticism can influence purchase intention (Barone et al., 2000; Gupta &Pirsch, 2006; Szykman et al., 1997; Webb & Mohr, 1998). Barone et al. (2000) suggest that a high degree ofcongruency between a sponsoring company and a cause can influence consumer skepticism. A high degree ofcongruencybetween a company and a cause generates a high degree of consumer skepticism. This is due to

theperception that the company is exploiting rather than helping the cause (Barone et al., 2000)(Anuar& Mohamad, 2012).

Cynics are generally less likely to believe information fromany source and are especially likely to attribute advertising claims to selling motives rather than strict honesty. In fact, the authors referred to apilot study in which cynicsrejected testimonial and demonstration ad appeals more than did noncynics. Boththe conceptual definition and the specific items in the cynicism scale, however,indicate that it is more a general characteristic than is ad skepticism and more apersonality characteristic than a marketplace belief. It may be reasonable to assumethat the cynical person likely will be more skeptical of advertising, but the reversemay not necessarily follow. We expect that consumers may learn to be skeptical ofadvertising based on specific socialization or marketplace experiences withoutbeing generally cynical(Obermiller&Spangenberg, 1998).

Previous studies suggest that there are two motives for companies conducting partnerships with causes: extrinsicand intrinsic motives (e.g., Cui, Trent, Sullivan, &Matiru, 2003). Extrinsic motives are viewed with a higherlevel of skepticism than intrinsic motives. The reason for this appears to be that extrinsic motives can beperceived as egoistic or self-interested while intrinsic motives can be seen as altruistic or other interested (Cui etal., 2003). More specifically, self-interested motives are more likely to be viewed with a higher degree ofskepticism if a CRM campaign is perceived to be conducted mainly in order to generate higher sales and profits.On the other hand, other-interested motives can be viewed with a lower degree of skepticism because consumersperceive that a company's motive for conducting such a campaign is altruistic, i.e., to support a cause(Anuar& Mohamad, 2012).

Muehling (1987) developed a scale in an attempt to capture "a reasonable cross section of commonly held beliefs about advertising" (p. 35). His final list of20 items included 4 that we should expect to assess skepticism: (a) presents a truepicture, (b) is truthful, (c) is a reliable source of information, and (d) does not givepeople enough information(Obermiller&Spangenberg, 1998).

Extant literature suggests that negative information ismore attention getting, more carefully processed, and more dominantin evaluations than positive information (Baumeister et al., 2001). In addition,negative feelings are more strongly coded in consumer memoriesand can lead to negative impressions having greater influence onoutcomevariables (Cho, 2006). In an attempt to communicate their dispositionto incredulity toward the CSR practices of the retailer, skepticalconsumers are likely to share their doubts, verify their suspicions, andwarn others (Ferguson et al., 2011; Herr et al., 1991).Thus, consumers' skepticism toward the CSR efforts of the retaileris likely to inhibit their willingness to talk positively about the retailerto their friends and acquaintances(Skarmea&Leonidou, 2013).

We propose that ad skepticism results from other, more basic personalitytraits and general abilities and from the collection of marketplace experiences,which may be influenced by age and education. Ad skepticism is a belief aboutadvertising in general and, as such, is an input to general marketplace attitudes suchas attitude toward advertising in general and attitude toward marketing. Consumerswho are skeptical of advertising are apt to dislike advertising for that reason and,more generally, to dislike marketing and business. Thus, a consumer's personalityand life experiences shape his or her belief in advertising in general, which hasmutual influence relations with other beliefs and attitudes relevant to the marketplace.Ad skepticism influences responses to advertising appeals with consequenteffects on specific brand opinions and information-gathering behaviors. In general,we expect that consumers who are higher in ad skepticism should attend to ads less,should be less inclined to form beliefs consistent with ad claims, and should bemore likely to counterargue or denigrate sources. Thus, they should be lesspersuaded by ads, should be less affected in brand attitudes, and generally shouldrely less on ads for product information.

We further propose the likelihood that ad skepticism moderates responses tovarious advertising appeals. Consumers who are more skeptical because of greaterintelligence or higher self-esteem should be more responsive to complex

argumentsand less responsive to peripheral ad elements. Similarly, high skepticism may havericher cognitive structures with respect to advertising and may be more aware ofadvertising strategies, therefore less responsive to ads that employ subtle persuasivetactics (see Friestad&Wright, 1994). Because ad skepticism focuses on theinformation content of ads, we could expect it to account for more variance in theeffect of informational versus emotional appeals, "hard sell" versus "soft sell," andclosed-end versus open-end messages, for example. Skeptics also may be cynicaland, as suggested by Campbell (1995), may be less positively affected by testimonialsordemonstrations(Obermiller&Spangenberg, 1998).

CONCLUSION

Consumers todayare facedwith a huge floodofdifferent companies' advertisement and claims and so many reported cases of social responsibility of firms and brands. In such circumstances,consumer's skepticismisgrowingday by day andin mostcases lead tonegativeconsumerreactionto theactions ofthecompany, such as anger, suspicionandcynicism, distrust, as well asanunderstanding of corporate socia responsibilityandunderstandtheirhypocrisy. According to conducted researches,there are different factorsanddimensionsinfluencing skepticismtowards advertisements which will bebrieflydescribedinthe following table.Insert table 1 .

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Table 1

Influencing Factors	Constituent elements	Consequences
Valuable and honest Reliable and enough information information content product type consumer's personality consumer's life style gender *age*	corporate social responsibility Resilience to negative information Equity Word of mouth	Negative effects on: - CRM - to support and defend the company by generating counter-arguments in the face of negative publicity - brand attachments - brand loyalty positive effects on: - price sensitivity - brand switch